plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

WATER & WASTE TREATMI

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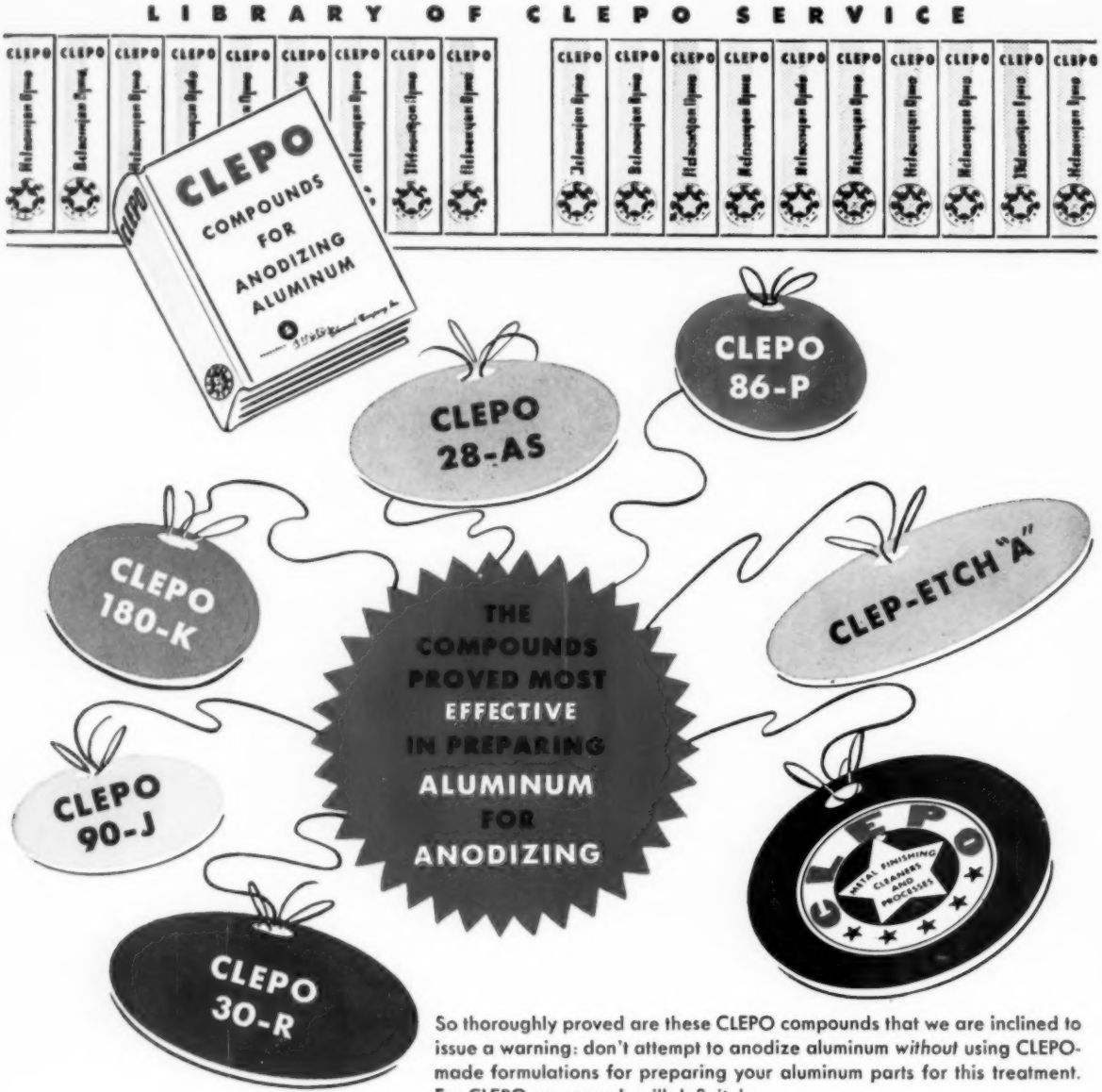

So thoroughly proved are these CLEPO compounds that we are inclined to issue a warning: don't attempt to anodize aluminum *without* using CLEPO-made formulations for preparing your aluminum parts for this treatment. For CLEPO compounds will definitely:

- remove oil and dirt without attacking the base metal
- remove buffing compounds without tarnishing the highest polish on the aluminum
- remove oxide and scale without dangerous acid
- remove smut after etching without fuming or hot acid
- remove smut from silicon-base alloys without hydrofluoric acid
- remove anodize coatings from rejects or racks without hot solutions

These are six outstanding CLEPO compounds useful in the field of anodizing, each formulated to do certain jobs best.

If your production involves anodizing, phone or write to have a CLEPO Field Service man call to demonstrate the benefits CLEPO compounds can bring you. Or if you have some particular steps that are bothering you and want a quick answer, send us the details. We'll be glad to make recommendations and send you a trial sample.

FREDERICK

G-8

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1. Strips chromium rapidly without current
2. Prevents cloudy, stained nickel plate
3. Provides good adhesion on zinc die castings, copper and brass
4. Descales heat-treated, welded, or brazed steel without attack
5. Allows re-nickel plating on top of old passive nickel plate
6. Dissolves red rust
7. Activates steel prior to plating or phosphating
8. Prepares cast iron for plating
9. Removes soldering flux

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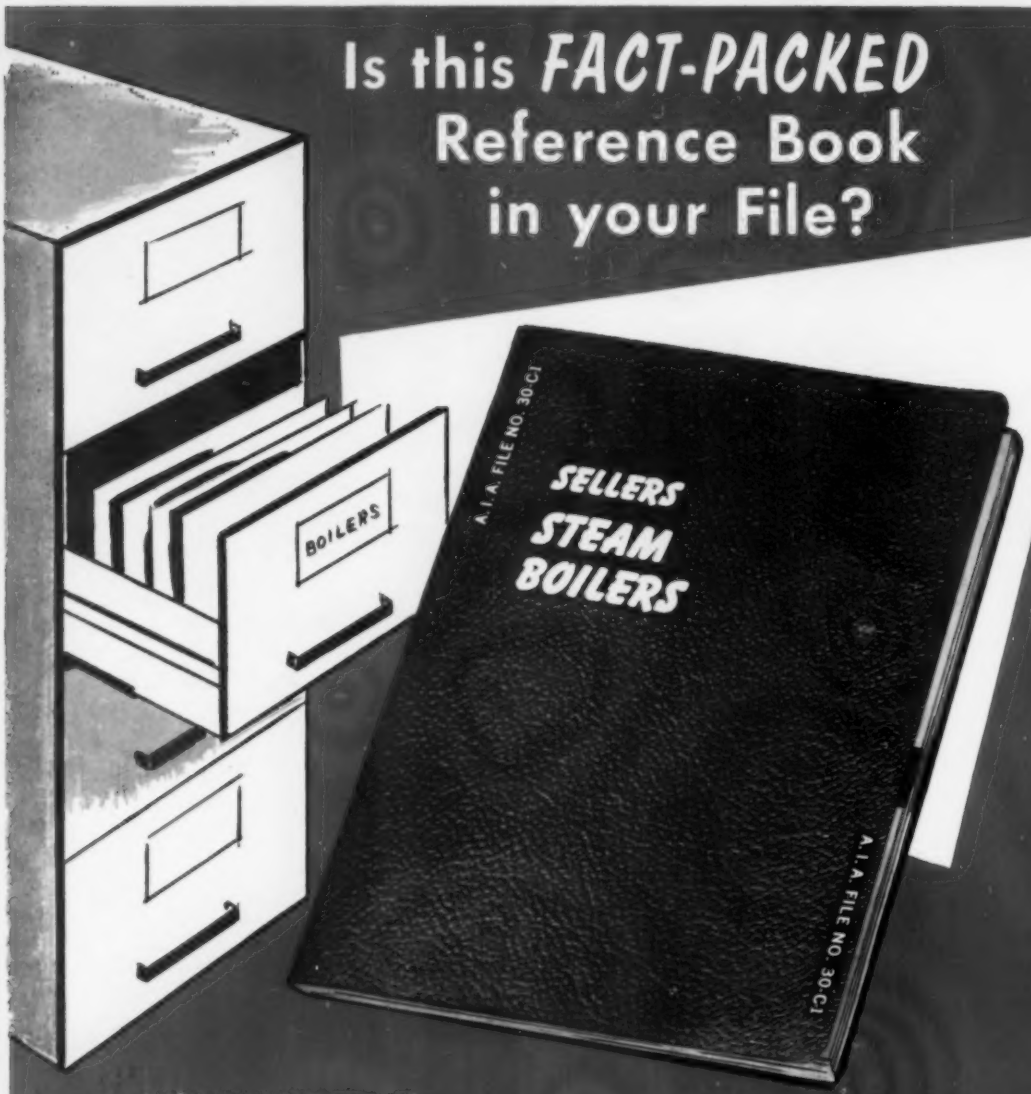

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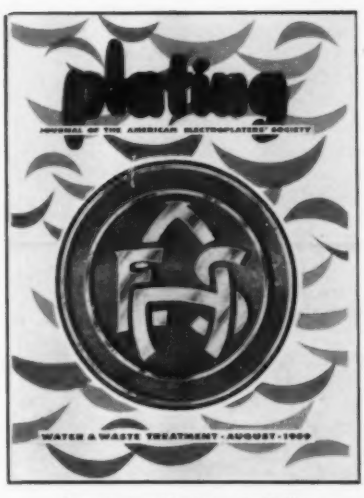

Cover Designed by James A. Civille.

plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

AUGUST 1959 — **Vol. 46, No. 8**

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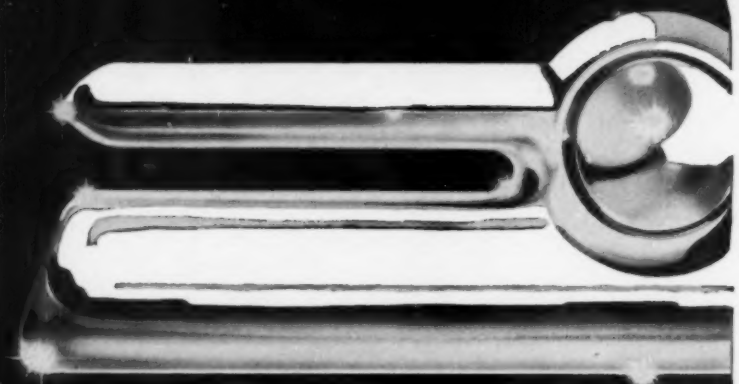
UNMATCHED CORROSION RESISTANCE



The No. 1 Feature of

HARSHAW PERFLOW PERGLOW DUPLEX *Nickel Plating Process*

Harshaw's research and development laboratory solved the problem of plating nickel on nickel. This, coupled with the use of a sulfur-free nickel plate and a bright nickel from a compatible bath, has made possible a Duplex deposit with unequalled corrosion resistance.

EXCELLENT CORROSION PROTECTION ACHIEVED THROUGH USE OF A SULFUR-FREE DEPOSIT

The Harshaw Chemical Company after years of research and development work was the first to find that a *sulfur-free* nickel offers greater corrosion resistance. This fact led to the development of the Harshaw Perflow nickel plating process. Further research showed that use of the sulfur-free Perflow nickel deposit as a base coating, followed by a bright nickel deposit from a *compatible* bath, would give a Duplex deposit with a further improvement of corrosion resistance. Performance data, by both accelerated tests and outdoor exposure, from leading automobile manufacturers and parts suppliers indicate that the Harshaw Perflow-Perglow Duplex nickel plate is comparable to and frequently better than, buffed gray nickel and is unequalled by any bright nickel.

MANY OTHER ADVANTAGES

1. Exceptionally high plating speeds —with air or mechanical agitation.
2. Excellent Chrome-Coverage.
3. Unsurpassed Leveling Characteristics.
4. Outstanding Brightness.
5. High Tolerance to Impurities.
6. Excellent Adhesion.
7. Excellent Ductility at Full Brightness.
8. Simplified Control — Stable over extended periods of operation.
9. Controlled Stress.
10. Uniform Protective and Decorative plate on both steel and zinc die castings.

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EDITORIAL

LOST OPPORTUNITY

ONE OF THE FINEST OPPORTUNITIES available to the membership of our Society for the exchange of new ideas so vital to the strength of any educational society is becoming stagnant because of an apparent lack of interest. The Bylaws of the Supreme Society, in all clarity, indicate that local Branches of the Society should display at Annual Meetings, specific examples of advances being made in our field. This is the "Lost Opportunity" to which we should give careful consideration.

Your Supreme Society, by stipulating in the Bylaws that an Exhibits Award Committee be formed, clearly saw the importance of fostering Branch Exhibits at Annual Meetings. Those responsible for this by Bylaw provision, realized that we are by choice and long-time demonstration, an educational Society dedicated to the advancement of the arts and sciences of electroplating, metal finishing and allied arts. How can the status of these advancements better be illustrated than through a well-organized Branch Exhibits program as visualized by our Bylaws.

There are numerous communicable methods by which ideas may be placed before the AES membership. Books, printed articles and lectures are perhaps the means that first come to mind, but what better way to show the actual progress than through a visual display.

Branches participating in such an effort on a national scale would thereby help fuse ideas from one area with those of another to create an effective whole important to the purpose of our Society. Indeed, a spirit of friendly cooperation would surely develop resulting in even closer relationship among Branches as well as a development of individual awareness of one's responsibility to the entire field of our endeavor.

Ideas presented orally are effective, of course, but are subject to misinterpretation because of our unconscious assumptions about language. As a scientific Society, we realize the necessity of "seeing and doing." This is basic for education as a whole and imperative for an educational Society.

Our socially pooled knowledge is of great value because it gives us accurate images of experience. I am speaking to each individual member when urging, "Rid yourself of complacency toward Branch Exhibits. Ignite the spark in your Branch—regain this 'lost opportunity'—demonstrate what your Branch can educationally accomplish through the medium of Branch Exhibits in this dynamic period of scientific and technical advancement."

Chester G. Bortel

Second Vice President

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The Interlox line was developed by Northwest's Cleaning Specialists to give you a better, lower cost, easily controlled phosphate base for organic finishes.

Interlox iron phosphate products deposit a high quality, fine grained, dense coating with great speed and dependability.

There is an Interlox product developed to meet your particular need whether spray or immersion type, single or multiple stage. Interlox baths are unusually long lived and require less additions and control.

Northwest's production-tested chemicals and dependable recommendations will save you money. Your Northwest Cleaning Specialist can give you expert advice on any cleaning or phosphatizing problem.

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MEMO TO ADVERTISERS

Facts as the basis of advertising investments

AUDITED PAID CIRCULATION ABC

Once upon a time, all business men who advertised were, willing or unwilling, perforce speculators. They couldn't help it, because in those days they had no way of knowing what they would get for their money.

Today, advertising money can be invested *on the basis of facts*—the information in the reports of the Audit Bureau of Circulations, a cooperative, nonprofit association of nearly 4,000 advertisers, advertising agencies, and publishers. The ABC has established standards for measuring the circulation of newspapers and periodicals, just as there are definite standards for the weights and measures of merchandise.

This magazine is a member of ABC. Our circulation is audited by experienced circulation auditors. The *facts* thus obtained are issued in ABC reports which show how much circulation we have, how it was obtained, where it is distributed, and other information that tells business men what they get for their advertising money when they invest in these columns.

Ask to see a copy of our ABC report.

Through the reports issued by the Audit Bureau of Circulations, this magazine, along with other publisher members of ABC, voluntarily and regularly give the buyers of advertising more verified factual information than is available for any other advertising media at any time.

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Now-28 ISOBRITE® PLATING BRIGHTENERS

For Zinc, Cadmium, Copper and White Brass

HAVE THE *FOUR* BIG FEATURES YOU ASKED FOR!

When the Allied line of brighteners, now known as ISOBRITE, had the famous ARP trademark on them, we made a survey to find out exactly what *you* wanted most in brighteners. Your answers helped guide our research and development staff in evaluating and consolidating our new line.

Now, here are the results—the industry's most complete line—28 *ISOBRITE Brighteners with these most-wanted features:*

1. LONGER LIFE

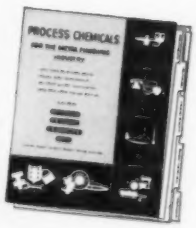
Your own records will show ISOBRITE Brighteners give longest possible life in rack or barrel plating operations.

2. BRIGHTNESS

You'll see for yourself that ISOBRITE Brighteners give a diamond-like sparkle that just can't be matched.

3. THROWING POWER

Even if your product has deep recesses, you'll get a uniform, all-over brightness that only ISOBRITE Brighteners can give you.



4. WIDER BRIGHT RANGE

ISOBRITE Brighteners operate efficiently over exceptionally wide current density ranges and have greater tolerance for temperature change.

Remember, there's an ISOBRITE Brightener especially designed for your specific operations—whether you're rack or barrel plating zinc, cadmium, copper or white brass . . . an ISOBRITE Brightener that is entirely compatible with most other brighteners. Don't just order brighteners—specify ISOBRITE. There *is* a difference!

Your Allied Finishing Systems Engineer will be glad to discuss the benefits of ISOBRITE Brighteners in your operations. He's listed in your 'phone book under "Plating Supplies." Or, write for technical data and product list giving details of your operations.

Allied Research Products, Inc.

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Branch Plant: 400 Midland Avenue, Detroit 3, Michigan
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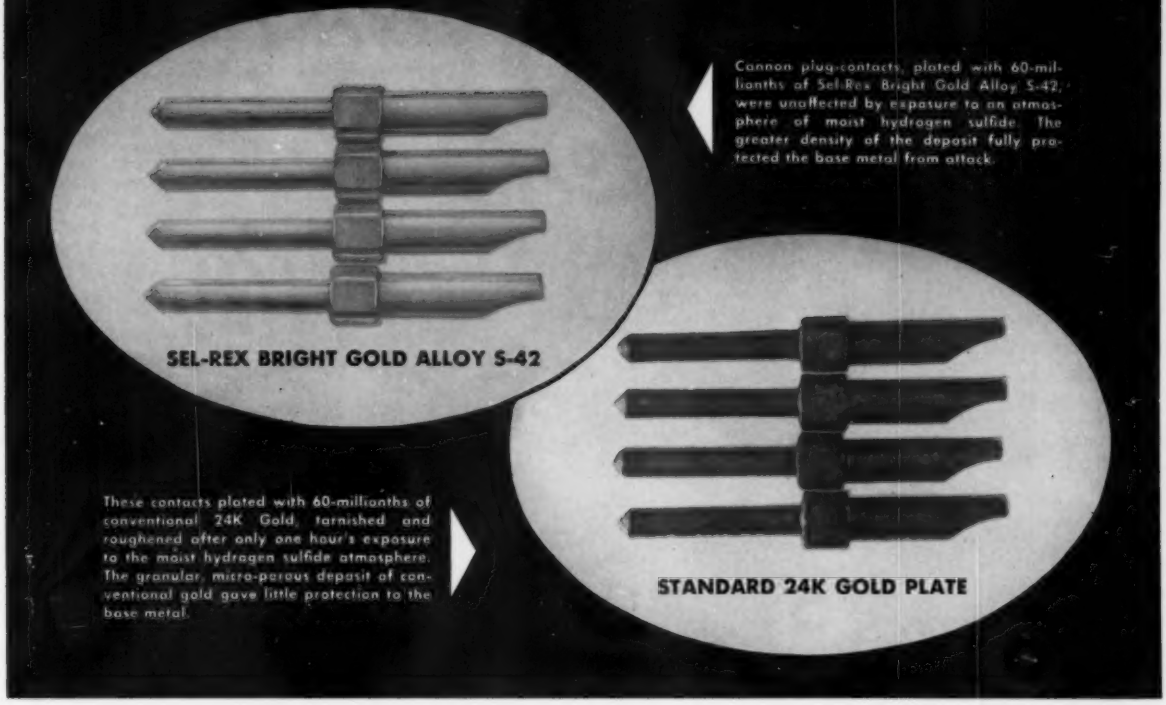
Chemical and Electrochemical Processes, Anodes, Rectifiers, Equipment and Supplies for Metal Finishing

IRIDITE® Chromate Coatings | IRILAC™ Clear Coatings | ISOBRITE® Brighteners | ARP® Plating Chemicals | WAGNER Equipment

CANNON ELECTRIC improves contact performance with SEL-REX Bright Gold Alloy S-42


Cannon plug-contacts, plated with 60-millionths of Sel-Rex Bright Gold Alloy S-42, were unaffected by exposure to an atmosphere of moist hydrogen sulfide. The greater density of the deposit fully protected the base metal from attack.
SEL-REX BRIGHT GOLD ALLOY S-42
These contacts plated with 60-millionths of conventional 24K Gold, tarnished and roughened after only one hour's exposure to the moist hydrogen sulfide atmosphere. The granular, micro-porous deposit of conventional gold gave little protection to the base metal.
STANDARD 24K GOLD PLATE

Contacts used in world-famous Cannon Plugs must be capable of withstanding corrosion and tarnish, in addition to the punishing effects of repeated engagement and disengagement. The photographs, taken by Cannon in their own laboratory, show why conventional 24K gold plate failed to meet the requirements of this application.

Both samples were plated with 60-millionths of gold over silver plate, and were photographed after an hour's exposure to an atmosphere of moist hydrogen sulfide. The contacts plated with 24K gold tarnished and roughened – those plated with Sel-Rex Bright Gold Alloy S-42 retained their original mirror-bright finish.

Says Cannon Electric Company, Los Angeles: "Our brass contacts plated with Sel-Rex Bright Gold Alloy S-42 offer exceptional protection against both corrosion and friction-wear. Some of the advantages we have demonstrated in our own laboratory, and what they mean to us, follow:

"**1. Greater Hardness:-** Knoop 140-160 for Sel-Rex Bright Gold Alloy S-42, compared to only 40-50 for conventional 24K gold plate.

"**2. Greater Wearability:-** The S-42 deposit is smooth and bright. This, in combination with hardness, means that less force is required to separate the mating halves of the connector . . . less wear, less tendency for galling."

"**3. Improved Reliability:-** Ordinary 24K gold plate is quite granular and exhibits considerable micro-porosity. Tarnish, corrosion of the base metal and early failure in-service of the plated contact is the end result. The Bright Gold Alloy S-42, being a smoother, far more dense deposit, has demonstrated much greater protection against tarnish and corrosion in all the tests we have performed at Cannon.

"At Cannon Electric, Sel-Rex Bright Gold Alloy S-42 has been instrumental in solving wear and tarnish problems encountered in connectors used in aircraft, and intricate missile and electronic components."

The foregoing is just another of our many case histories which prove that: "From Missiles and Rockets to Misses and Lockets – there's a Sel-Rex Precious Metal Plating Process to help you make your product better, more salable."

For other case histories, technical information and application data, ask for ML-1.

PRECIOUS METALS DIVISION

SEL-REX CORPORATION

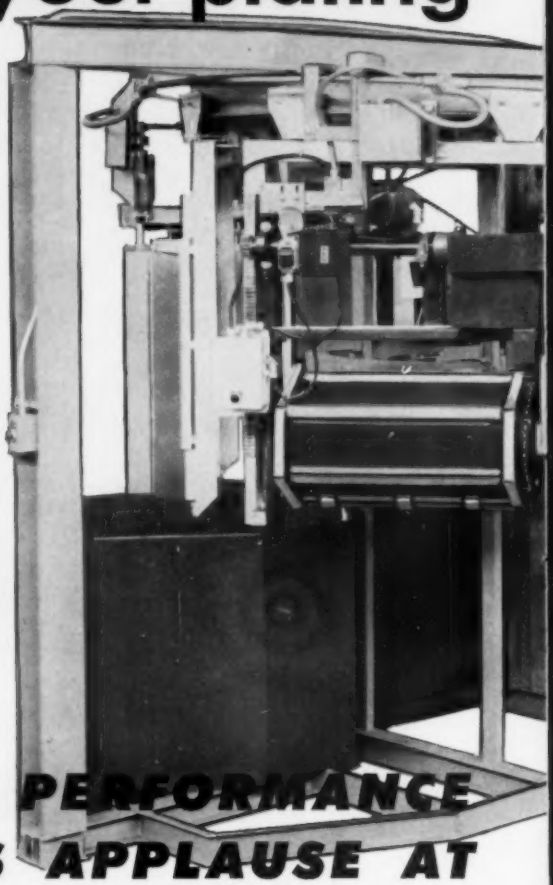
NUTLEY 10, NEW JERSEY

Manufacturers of Exclusive Precious Metals Processes, Metallic Power Rectifiers, Airborne Power Equipment, Liquid Clarification Filters, Metal Finishing Equipment and Supplies.

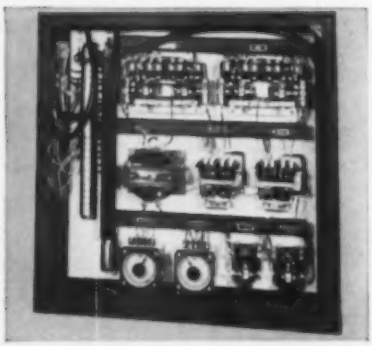
The V.I.P. is "Star" of A.E.S. Convention-Exposition

Seen by visitors on television and plant tours, the V.I.P. is here described by mistress-of-ceremonies on closed circuit telecast to the floor of the metal finishing show.

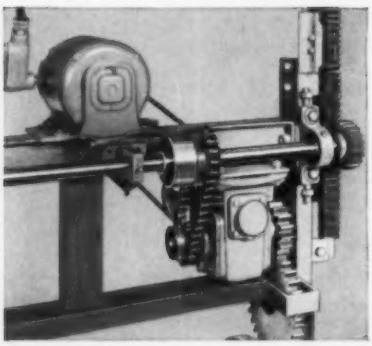
UDYLITE'S VIP* of your plating



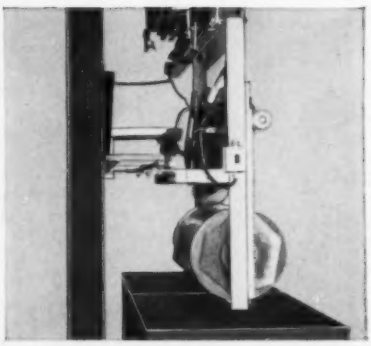
EXCITING PERFORMANCE BRINGS APPLAUSE AT



Reversing starters for lift and transfer motors, adjustable timers for delayed dips, down-dwells and drag-outs, and the relays for automatic machine operation are all centered in this single control panel.



Individual power unit for each barrel and carriage assembly provides cylinder rotation in the "down position". When reversed, an over-running clutch grips the shaft to raise the barrel for transfer to next station.



Side view of the V.I.P. carriage unit shows complete accessibility, for simple easy servicing, of all parts, anodes and solutions. The ample clearance around each unit also provides for excellent ventilation of the machine.

can be the STAR PRODUCTION

*V.I.P. Variable, Integrated Processing automation for a wide range of bulk finishing operations such as cleaning, plating, phosphating, etc.

IN BARREL AUTOMATION EXPOSITION FROM NOTED V.I.P.'S*

*(*very important platers)*

Executives, plating superintendents and engineers during the recent A.E.S. Convention were impressed and excited when they saw Udylite's new V.I.P. The extreme versatility of this new return type barrel machine was displayed in a way that amazed even automation experts. In action demonstrations, they envisioned new highs of cost cutting efficiency with this latest development of Udylite's equipment engineering team.

The result of years of careful study and intensive experiment is this hydraulically operated transfer system which puts a series of Udylite's famous long-life Tempron cylinders through an entire plating cycle . . . programmed by a single panel of adjustable controls. Guided by this "brain" the ingeniously simple "body" of the V.I.P. performs wonders of automatic processing.

When your production must be *both* fast and sure, here is what you can expect from the V.I.P.: High volume capacity coupled with the invaluable virtues of simple rugged construction, single, one man control and superb ease of maintenance. Above all, the amazing flexibility of this really versatile performer can establish the V.I.P. as the money making star of your finishing operations.

Learn today how the V.I.P. can, at once, raise your production and efficiency levels in a way you never before thought possible. Write, or see your Udylite representative for details, NOW!

the udylite corporation

detroit 11, michigan • world's largest plating supplier

Metals & Controls' Eastern Regional Manager C. J. Grube discusses with Gemex Master Electroplater Hy Libovitz one of Gemex's installations of a General Plate expanded platinum-clad tantalum anode (shown, left magnified size).

GENERAL PLATE
Expanded Platinum-Clad Tantalum Anodes

Reduce Platinum Costs, Speed Plating Time and Conserve Plating Solution for The Gemex Corporation

There are good reasons why The Gemex Corporation, a recognized leader for quality, workmanship and styling of Gemex watchbands, uses General Plate platinum-clad anodes.

Here's how Mr. Hy Libovitz, Superintendent, Finishing and Plating Department, Master Electroplater with 42 years of association with Gemex explains it: —

"General Plate platinum-clad tantalum expanded anode offers the most revolutionary advancement in modern day electroplating medium. It gives us such outstanding results as faster plating time, complete circulation of plating solution, and it conserves our rhodium plating solutions."

Platinum clad to one side of tantalum sheet, and then expanded to a mesh can substantially reduce your cost over solid platinum anodes. The greater distribution of anode surface obtained by expanded clad metal allows more uniform plating. The tantalum layer isn't affected by chemicals in the plating bath nor does it contaminate the bath.

Metals & Controls also supplies rhodium sulphate and rhodium phosphate solutions in unbreakable, transparent containers marked with graduations, and refines contaminated solutions.

Why not *reduce your cost* of rhodium electroplating by using General Plate expanded platinum-clad tantalum anodes and rhodium plating solutions? Write today for more information, or send us your specifications and we will gladly quote on your requirements.

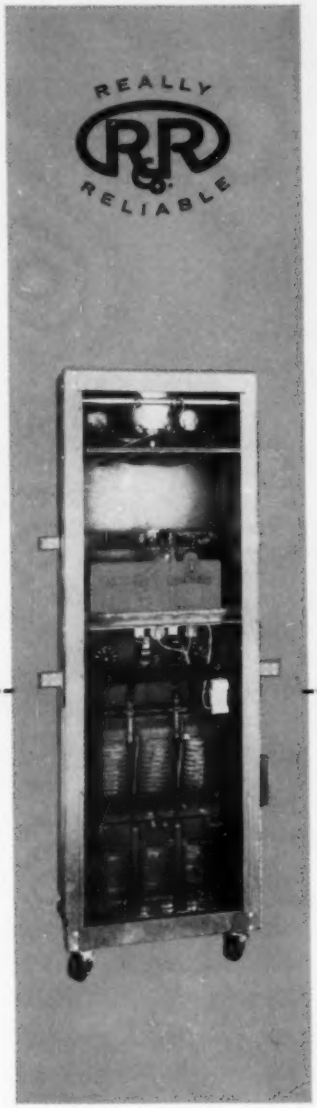
METALS & CONTROLS

1408 FOREST STREET, ATTLEBORO, MASS., U.S.A.

A DIVISION OF TEXAS INSTRUMENTS INCORPORATED

General Plate Products: Clad Metals • Electrical Contacts • Truflex® Thermostat Metal • Platinum Metals • Reactor Metals • Radio Tube & Transistor Metals

FROM GENERAL INSTRUMENT CORPORATION



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in plating equipment only Radio Receptor Tri-Amp Rectifiers* deliver *ALL* the advantages...

- Higher efficiency.
- Excellent overload characteristics.
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- No sudden failure.
- No special protective devices required.
- Operate in parallel or series without special precautions.

*Radio Receptor's Tri-Amp is a completely different concept in selenium. Rectification is accomplished through a P-N junction formed by a closely controlled diffusion process involving the use of cadmium-selenide and tellurium. No artificial barrier layer is used in the Tri-Amp thus eliminating the cause of aging and high voltage drop.

General Instrument, specialists in *all* types of semiconductors, finds that Tri-Amp is demonstrably superior in plating equipment. Leading manufacturers now use Tri-Amp as standard components in their plating rectifiers and a list of users, plus more detailed information, is available upon request. Write today to Section P-1.

RR RADIO RECEPTOR
AUTOMATIC MANUFACTURING

GI

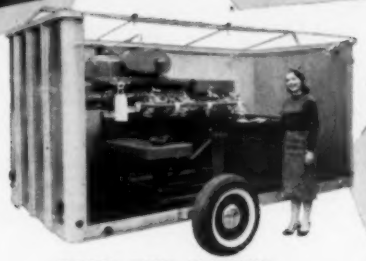
RADIO RECEPTOR COMPANY, INC.
Subsidiary of General Instrument Corporation
240 Wythe Ave., Brooklyn 11, N. Y., Telephone: Evergreen 8-6000

GENERAL INSTRUMENT CORPORATION INCLUDES F. W. SICKLES DIVISION, AUTOMATIC MANUFACTURING DIVISION, RADIO RECEPTOR COMPANY, INC. AND MICAMOLD ELECTRONICS MANUFACTURING CORPORATION (SUBSIDIARIES)

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 809.

"Little Steve" STARS AT A.E.S. EXPOSITION

NOW YOU CAN SEE "Little Steve" RIGHT IN YOUR OWN PLANT



BRING THIS STEVENS "ROAD SHOW" TO YOUR DOOR

Thousands of visitors to the A.E.S. Exposition saw the "Little Steve" automatic plating and processing machine in action. Perhaps you were one of the many who said they wished others in their organization could see this remarkable machine perform.

Now the mobile display model can be brought directly to you. At your request, a Stevens representative will arrange a special showing. "Little Steve" will be put through its paces before the eyes of your entire staff right in your own plant.

Avail yourself of this remarkable opportunity today. Merely send a request on your company letterhead and a private viewing of "Little Steve" will be promptly arranged. Just address your request to:

frederic b. STEVENS, inc.

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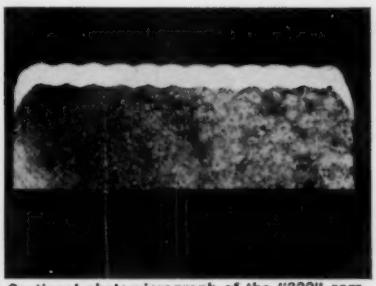
Skilled plater lowers an electrode with Perfect Circle piston rings into a bath of Mutual® Chromic Acid.

Photo shows the Perfect Circle "200" chrome top compression ring (L) and "98" self expanding oil ring (R). The face of the compression ring and the steel rails of the oil ring are plated with solid chrome .004"-.007" thick.



Sectional photomicrograph of the "200" compression ring shows interrupted surface and thick plating of chrome.

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A Timely Message on

New Facets of Alaska and Hawaii Statehood

by Ben P. Sax

Chairman of the Board, *American Buff Company*

Many businesses in our 48 states have been feeling the effect of the addition of our 49th and 50th states. Depending upon their product, you'll hear the situation described as a great step up, or a costly step down.

Map-makers, for instance: an inventory of maps becomes junk — United States maps and all their related statistical information must be revised. Yet in turn, this creates a huge new market in schools, business and libraries, etc., where the latest authoritative information is a "must". So, too, with the entire flag industry. And in the field of games (of all places) what a change! One of the biggest game producers estimates that popular games based upon the 48 states will create obsolete stocks as high as 60,000 games with an approximate value of $175,000.00. One encyclopedia publisher estimates editorial changes for Alaska, alone, will affect over 300 pages.

But there's a shiny future of expanding markets for many metal products. Metal components as well as complete products will be on the rise, particularly in the new surge of Alaska homesteaders, and in the huge mass markets of Hawaii.

We hope that our know-how in helping the metal finisher to produce economically and beautifully will soon "show" in the possessions of our new U.S. citizens.

Sincerely,

Ben P. Sax

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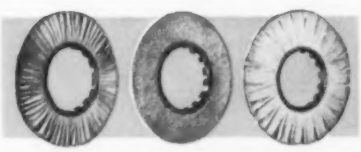

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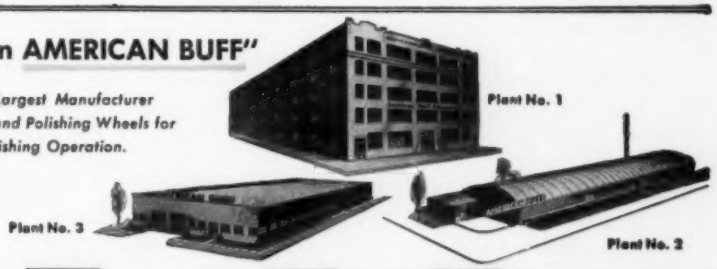

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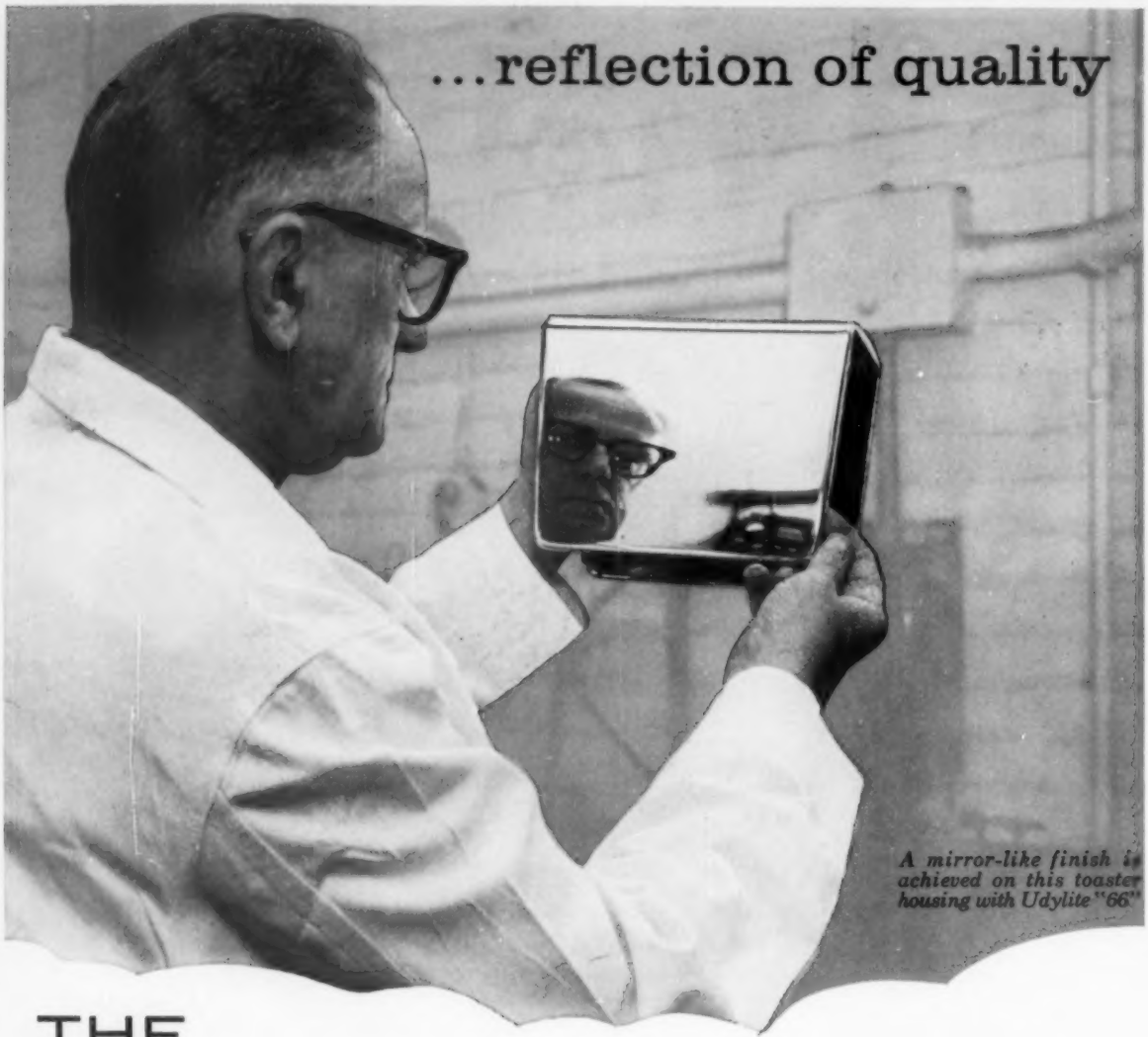

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Three stages in finishing a zinc base die casting. Buffed part (center) is followed by electrocleaning in Oakite 195 (right). Hand holds plated part. Notice how electrocleaned part at right retains all the luster and color of the buffed part.

New Oakite electrocleaner assures brighter plate, fewer rejects for zinc die castings

It's non-etching and non-discoloring — that's why new electrocleaner Oakite 195 assures a brighter chromium luster, fewer plating rejects. Used with direct, reverse or periodic reverse current, it removes soils without dulling or darkening the buffed surface. It makes plating of zinc die castings a more dependable, more economical operation. Proof? Many users report *no* rejects due to poor electrocleaning *for the first time* in their experience.

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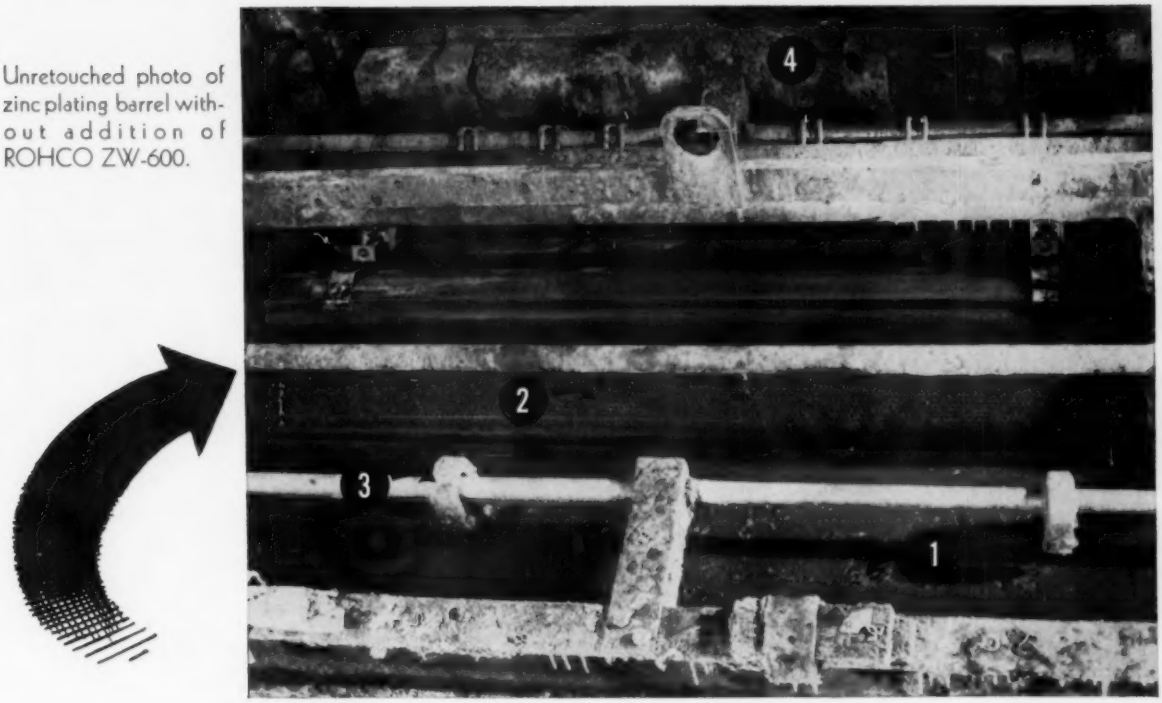
Do Your Zinc Barrels LOOK Like This?

Unretouched photo of zinc plating barrel without addition of ROHCO ZW-600.



1. Does the surface of the zinc plating solution become covered with grease and sludge?
2. Do the holes in the barrel plug up?
3. Do you lose electrical contact between the anode baskets and rods?
4. Do tank rims become encrusted with salts—look unsightly and cause electrical shorts?

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ZW-600—a newly developed wetting agent for use in zinc plating baths gives better rinsing and usually will pay for itself by reducing dragout.

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7.22 x 10^{-6} in/in per °F
Thermal conductivity
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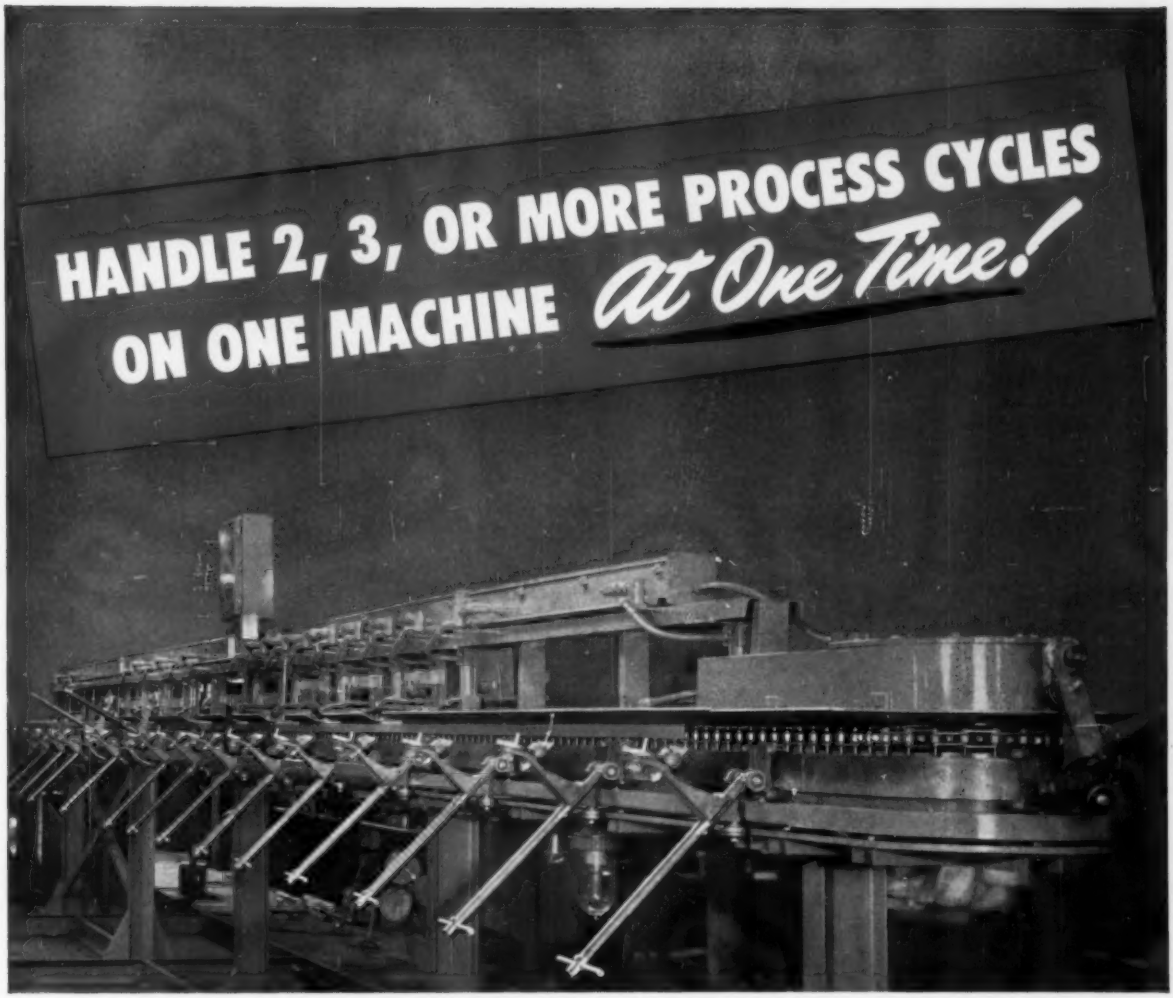

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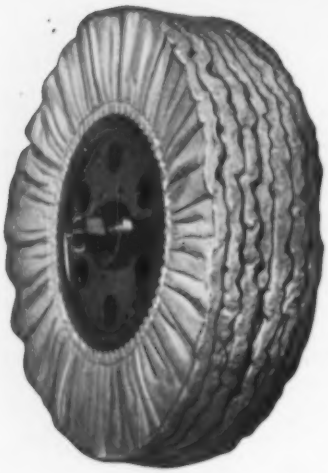

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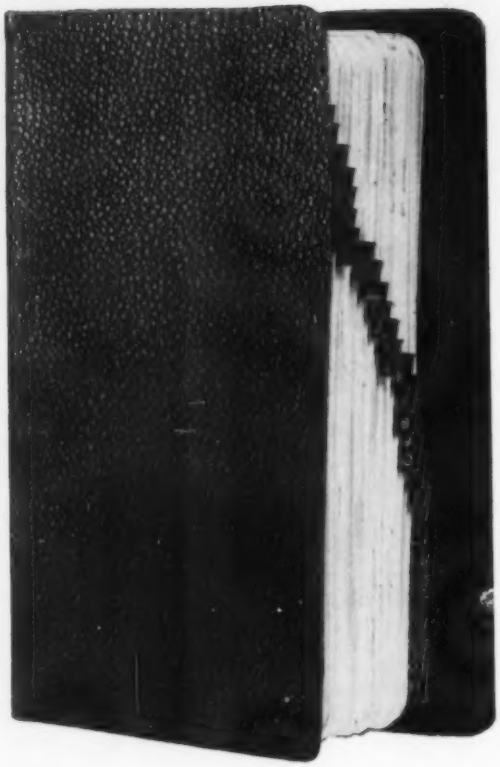

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- Removing soldering flux from brass
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The main plant of the International Business Machines Corporation in Rochester, Minnesota.

DESIGN AND OPERATION PROBLEMS OF A CONTINUOUS AUTOMATIC PLATING WASTE TREATMENT PLANT

by NEIL H. HANSON* and WALTER ZABBAN**

INTRODUCTION

The manufacturing plant under discussion is located west of Route 52, within the city limits of Rochester, Minnesota. It manufactures twenty-one types of electromechanical data processing machines including punches, collators and card reproducers. Recently it was chosen by Factory Magazine, from over 700 entries, as one of the ten top plants built in 1958. The manufacturing process is complete from raw stock to finished assembly and testing; although some parts are procured from subcontractors.

The advantages and facilities of Rochester make the city ideally suitable for a manufacturing plant of this type. However, the Zumbro River, which offers the only means of surface waste disposal, is approximately two miles from the plant. Because of this, the industrial waste effluents from the plant are piped to city sanitary sewers, thereby reducing the transportation problem considerably. A dilution factor cannot be depended upon as the Zumbro River is periodically subject to low flows.

Because it was decided to discharge the treated industrial wastes into the city's sanitary sewers, authorities required that the contaminants be removed to the extent that none of the discharges would interfere with the operation of the municipal sewage treatment plant. Furthermore, the treated waste must not interfere with aquatic life in the Zumbro River if a portion of the sanitary sewage bypasses the sewage treatment plant.

PROCESSES CONTRIBUTING INDUSTRIAL WASTES

All facilities for the processing building were designed and construction was supervised by IBM Rochester employes. The waste disposal facilities were designed and constructed under the supervision of consultants.

Contaminated industrial wastes may originate in the following three departments:

1. Plating
2. Mechanical Finishing
3. Heat Treating

Plating Department—The majority of contaminated industrial wastes are discharged by this department. The building housing the plating department has been designed so that the plating facilities can satisfactorily serve a manufacturing plant twice as large as the present facility. There are five automatic plating machines: a cadmium barrel, cadmium rack, nickel rack, chromium rack and chromium finger machine. In addition, there is an automatic stripping rack and barrel machine used to prepare parts for machining and strip copper after heat treatment. There are also a number of individual tank lines for small "job shop" type production runs. These include a chrome rack line, a tool chrome line, a barrel chrome line, an anodizing line, a multipurpose stripping line, a cadmium rack line, a copper-nickel rack line and a semi-automatic copper-nickel barrel line. These facilities require 16,000 square feet of floor area.

Each tank requiring ventilation is exhausted to an underfloor tunnel. The volume of gases exhausted is based on tank size, temperature, contents, and use, in accordance with the recommendations of the American Standards Association Code Z-9.1. The recommendations have been found to be excellent for desirable health and comfort standards. To replace the air exhausted from the plating department it is necessary to provide enough supply air for a complete room air change every two minutes. By eliminating fume scrubbers from the ventilation system exhausting the plating tanks, the expected load on the waste treatment plant has been reduced. A careful check was made of areas surrounding buildings that

* Plant Engineering, IBM, Rochester, Minnesota.
** Partner, The Chester Engineers, Pittsburgh, Pennsylvania.

house fume scrubbers and there were no indications of moisture fallout from saturated exhaust air at the several installations visited. Fallout is less likely to occur if the air is discharged only forty per cent saturated and not washed. For added insurance against fallout, exhaust duct air velocities are dropped below 1000 fpm to cause the moisture droplets from certain plating processes to fall out of the air in the duct. The duct is pitched to a water trap and moisture eliminator plates before entering the exhaust blower. As the air leaves the building through two stacks rising eight feet above the roof, the velocity is raised to 3000 feet per minute or higher for maximum dispersion of plating moisture. The assumption was successfully made that incorporation of these features into the exhaust system would make fume washers unnecessary.

The area surrounding the plating building has been checked for signs of chromic acid stains on snow and other surfaces, and to date none have been found. A potential load on the industrial waste treatment plant has been eliminated by omitting the use of water for absorption of fumes.

Mechanical Finishing Department—The mechanical finishing department is primarily concerned with the chemical and mechanical surface polishing of metal parts used in manufacturing. Since the effluent from these operations does not contain substances in sufficient quantity to be harmful to aquatic life or the biological treatment provided by the municipal sewage treatment plant, those wastes are discharged directly into the sanitary sewers without treatment.

Heat Treating Department—The only wastes from this department requiring treatment are from the liquid carburizing operations. Molten salt baths containing sodium cyanide are used in these operations and must occasionally be dumped. When this occurs, the spent salt is placed in a perforated basket and slowly dissolved in water. The water containing cyanide is conveyed to the waste treatment plant.

The dragout from carburizing furnaces is carried either to oil or brine quenching baths. Any dumpings of oil would be disposed of by burning. The brine quenching baths are discharged when dumped into a plating department collection tank for later treatment of cyanide.

PRELIMINARY DESIGN

It was evident from the beginning of the project that almost all of the industrial waste effluents from the manufacturing operations, which required treatment, would originate in the plating department.

Prior to design of the existing industrial waste treatment facilities, the plating lines had been designed without consideration for water consumption nor for the eventual cost of facilities required to treat large volumes of waste. On the basis of previous design, flows were expected to be at a rate of 810 gallons per minute.

In an attempt to reduce rinse water consumption from city owned wells to a minimum, the proposed plating lines were redesigned, the number of rinses following the various processing tanks was changed, and some of the immersion type rinses were complemented with spray stations.

The size and type of parts to be plated were known. Volumes and concentrations of contaminants in the wastes could then be determined by calculating from information in literature and experimental data obtained from the IBM Kingston, New York plant, and the plating experience of IBM Rochester personnel and consultants.

The first step was to determine the carryover or dragout of liquid from the process solutions to the rinses. According to a tabulation published in Electroplating Engineering Handbook by A. K. Graham, page 592, the following volumes of carryover are representative of the type of parts processed and the manner in which parts are drained prior to rinsing:

TABLE I

	Dragout Gal/1000 Sq Ft
Vertical parts, well drained	0.4
Vertical parts, poorly drained	2.0
Vertical parts, very poorly drained	4.0
Horizontal parts, well drained	0.8
Horizontal parts, very poorly drained	10.0

In addition to the above information, experimental data collected at the IBM Kingston, New York plant yielded dragout figures of 2.5 to 4.0 gallons per 1000 square feet of essentially flat parts.

From the above information the following dragout figures were assumed for design criteria:

TABLE II

Rack plating	5 gal/1000 sq ft
Large barrel plating	0.3 gal/bbl
Small barrel plating	0.003 gal/bbl

Dragout values for barrel plating were based on number of pieces in the barrels, their area and configuration.

Hourly volumes of dragout were calculated from the data on area of parts and barrels to be processed per unit time. The amount of contaminants discharged in waste was calculated from data on dragout and composition of various processing solutions before the rinses.

To determine the flow of rinses, a standard was established for maximum allowable contamination of the final rinse preceding or following each processing operation.

The following was adopted as the allowable concentration of contaminants in the final rinses:

TABLE III

Nickel salt	0.005 oz/gal	(39 ppm)
Cyanide salt	0.005 oz/gal	(39 ppm)
Chromium	0.002 oz/gal	(16 ppm)
Alkaline cleaner	0.1 oz/gal	(780 ppm)
Acid	0.1 oz/gal	(780 ppm)
Acid prior to chrome plating	0.002 oz/gal	(16 ppm)

This information was incorporated into a well known formula adapted to countercurrent rinsing applications which, in its simplified form is as follows:

$$F = \frac{S}{t}\left(\frac{C_o}{C_f}\right)^{\frac{1}{n}}$$

Where C_f = Final concentration of contaminants in rinse (oz/gal)
C_o = Concentration of contaminant solution (oz/gal)
F = Flow of fresh water (gal/min)
n = Number of rinse tanks
S = Dragout (gal)
t = Time interval between rinsing operations (min)

Table IV illustrates savings effected by countercurrent multiple rinsing methods.

TABLE IV

	C_o	C_f	Water required for equiv. rinse (gal/min) 3 rinses	2 rinses	1 rinse
Chrome	53.0 oz/gal	0.002 oz/gal	1	5.7	889.0
Cyanide	13.1 oz/gal	0.005 oz/gal	1	3.7	189.0
Cleaner	4.0 oz/gal	0.1 oz/gal	1	1.9	11.7
Acid	32.0 oz/gal	0.1 oz/gal	1	2.6	47.0
Acid	32.0 oz/gal	0.002 oz/gal	1	5.1	635.0

This table illustrates the effect of two and three rinses. Where the concentration rate $\frac{C_f}{C_o}$ is high, the effect is more pronounced. An example is the high density chromium bath which requires a more thorough rinse. In this case, one gallon per minute for three counter-current rinse tanks is as effective as 889 gallons per minute in a single rinse tank.

Conversely, where the ratio is low (as in the rinse after cleaning), a second or third rinse tank is unnecessary.

The equation and the aforementioned information provided the following flow rates:

TABLE V

General rinses	71 gpm
Chromate rinses	11 gpm
Cyanide rinses	20 gpm
Total	102 gpm

A recalculation of the above flows, as determined on the basis of practical flows which could be obtained by control, yielded the following information:

TABLE VI

General rinses	83 gpm
Chromate rinses	15 gpm
Cyanide rinses	22 gpm
Total	120 gpm

With the addition of a safety factor the following flows were adopted for design:

TABLE VII

General rinses	125 gpm
Chromate rinses	35 gpm
Cyanide rinses	40 gpm
Total	200 gpm

All of the above information describing the procedures for determining waste flows was calculated by the authors and others mentioned in the acknowledgements (at the end of the article). This information has been published in an IBM Technical Report titled, "Determination of Rinse Water Requirements for Plating Processes," by H. W. Parker, dated June 27, 1958.

Based on a flow of twenty gallons per minute for the cyanide rinses, the concentration of total cyanide in those rinses (Table V) was calculated to be 700 parts per million of CN. On the basis of a flow of eleven gallons per minute for the chromate rinses, the concentration of hexavalent chromium was calculated to be 1300 parts per million, as Cr. The above figures do not include the discharge of spent solutions which, when pumped to a basin at the treatment plant and batch treated over a period of one week, normally will not interfere with continuous treatment of other waste. However, if the dumps are discharged as part of the regular waste, they can more than double the continuously treated concentrations and thereby exceed plant capacity. The general rinses are normally expected to be acid and increases in concentration, due to the discharge of any spent solutions, can be continuously treated by adjustment of *p*H.

CONSERVATION OF PLATING DEPARTMENT WATER

When calculations had proven that the reduced flows could properly rinse processed parts, the problem became that of providing mechanical means to control the flow of rinses within the calculated values. The number of rinses following each step had already been determined by calculation. The problem then was to provide the number of tanks required after each processing step so they could be piped in series by use of countercurrent rinsing.

Flow control valves* were selected to control all flows at the calculated value required for maximum tank usage. These valves maintain a constant flow of liquid irrespective of pressure on the line, and are available for any flow to 10 gpm. For control of flow rates in excess of one gallon per minute, conductivity cells** were also utilized. As 100 per cent design loads are seldom reached, it is very advantageous to use these probes since they control fresh water supply on the basis of degree of contamination of the rinse in which the conductivity cell is immersed.

The conductivity cell measures the conductivity of water. Conductivity of a rinse increases as the rinse becomes more contaminated. Therefore, by selecting a conductivity limit which corresponds to the allowable limit in concentration of contaminants, the cell can operate a solenoid valve regulating the water flow into the rinse tanks. A single panel† receives signal from up to twelve individual conductivity cells, and intermittently transmits signals to a solenoid valve on each tank which in turn supplies water to the tank. The flow valve†† has the additional function of preventing excess flow in case of malfunction and during the two minute time lapse before the Solu-Bridge again signals the solenoid valve to close.

Because of the relatively small flow of water to the rinse tanks it is necessary to agitate the rinses with air to maintain a uniform distribution of contaminants throughout the tank.

The effect of the concentration of contaminants on the conductivity cell reading is illustrated in Fig. 1, which shows the effect of varying concentrations of hydrochloric acid and sodium hydroxide in tap and demineralized water. Fig. 1 was extracted from an IBM Technical Report titled, "Solu-bridge Calibrations for Department 092" by Dr. W. Wade, dated December 29, 1958. Note that the instrument is more sensitive to concentrations of contaminants or dissolved solids in demineralized water than in tap water. Fig. 2 illustrates the installation of the control system.

In addition to the controlled valves and the flow control valves, automatic valves are mounted on water lines leading

* Dole Valve Co., Wolcott St. & Carroll Ave., Chicago, Ill.
** Trade named "Solu-Bridge," manufactured by Industrial Instruments, Inc., Cedar Grove, N. J.
† Solu-Bridge panel.
†† Dole valve.

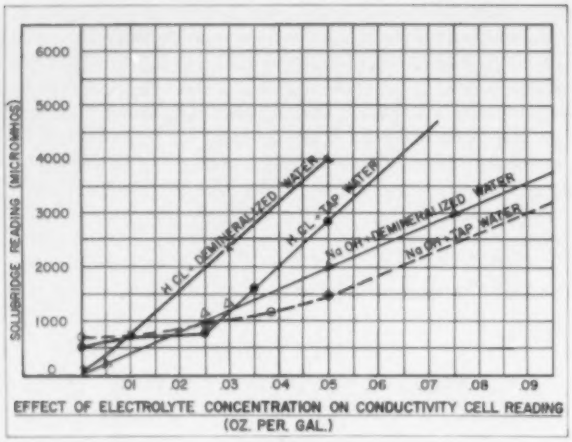


Fig. 1

to automatic platers and still lines. The valves on the automatic machines open only when an electric bypass switch is thrown or when a machine cycle is started. Valves on each line to the still plating area are closed by manual electric switches when not in use.

Use of the aforementioned controls and acquainting operators with the value of water conservation has reduced the water flows to a present average total of fifty gallons per minute, without impairing the quality of plating surfaces and without exceeding the limiting concentration of contaminants.

All rinses preceding plating tanks and most of the final rinses following the plating tanks consist of demineralized water because the water used has a total hardness of approximately 300 parts per million. The need for dumping plating solutions due to accumulation of insoluble solids has been practically eliminated by using demineralized water rather than tap water for the rinses preceding plating tanks. The throwing power of plating solutions is also increased by fewer insoluble solids in the solutions.

CONSTRUCTION OF INDUSTRIAL WASTE TREATMENT FACILITIES

Work on design of the industrial waste treatment plant was initiated during the last week of October 1957, after calculations had been made of the expected flow rates and concentrations of contaminants in the wastes. Detailed plans and specifications were completed by mid-December 1957, and sent to engineering firms that furnish specialized equipment for industrial waste treatment. It was requested that bids be submitted by the middle of January 1958. The companies were requested to furnish all equipment specified and provide all necessary coordination, supervision and services for satisfactory installation of the equipment by the mechanical and electrical contractors.

It was decided to have specialists responsible for the equipment to accelerate construction and conserve the consulting engineer's time by relieving him from checking the selected equipment and accessories prior to delivery and checking the installation and functioning of the equipment.

The equipment contract was awarded to Graver Water Conditioning Company at the end of January. In the meantime the general contractor was setting the foundation and constructing the outside walls of the building.

The mechanical and electrical contracts were awarded at the end of February. By the third week of the following September the plant was completed, except for minor items, and was immediately put into operation under limited loads.

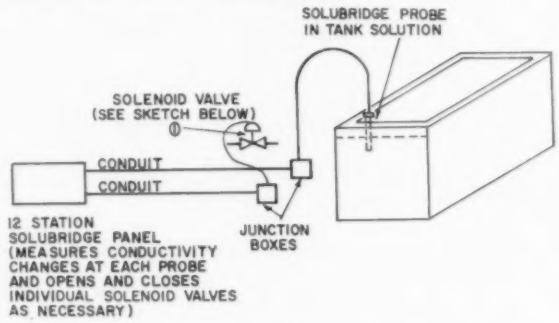
The need for an expeditious completion of the project was so urgent that for about a month some of the waste had been batch treated in collection sumps in Building 106, where the waste originates.

ARCHITECTURAL DESCRIPTION OF PLANT

The industrial waste treatment facilities are located in a separate building opposite the power plant. The building consists of a basement and a main floor which is at truck level. The main floor houses most of the mechanical equipment, the laboratory with the instrument panel, a chlorine and sulfur dioxide storage and feeding room and the vacuum filter. Also on this floor are extended hoppers for addition of chemical reagents to the chemical feeders below and the chemical storage room with the treatment basins located externally and adjacent to the building. The walkways and gratings on top of the basins are at the same level as the main floor.

The basement contains the motor control center, all pumps, hydrated lime feeders, chemical solution tanks, most accessories for the vacuum filter, the mechanical equipment, including the air compressor, the compressed air storage tank and the fresh water feeding system. In addition, the basement houses all transfer piping connecting each treatment basin.

The chlorine and sulfur dioxide storage and feeding room, which is not directly accessible from the interior of the building, has additional forced ventilation facilities consisting of four 1300 cfm fans mounted on the wall. These fans are capable of providing one complete air change every two minutes. Sealed (gastight) windows in the partition wall between the chlorine storage room and the laboratory enable the operator to inspect the room from the outside. The partition wall of concrete blocks is coated on the inside with an impermeable coal tar epoxy coating.



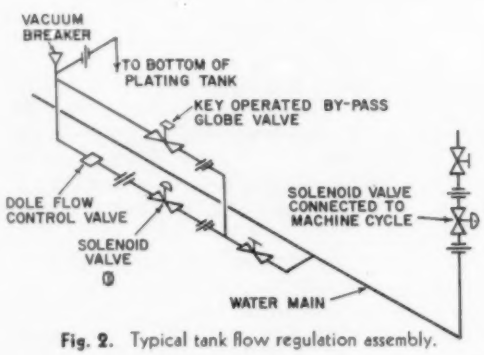
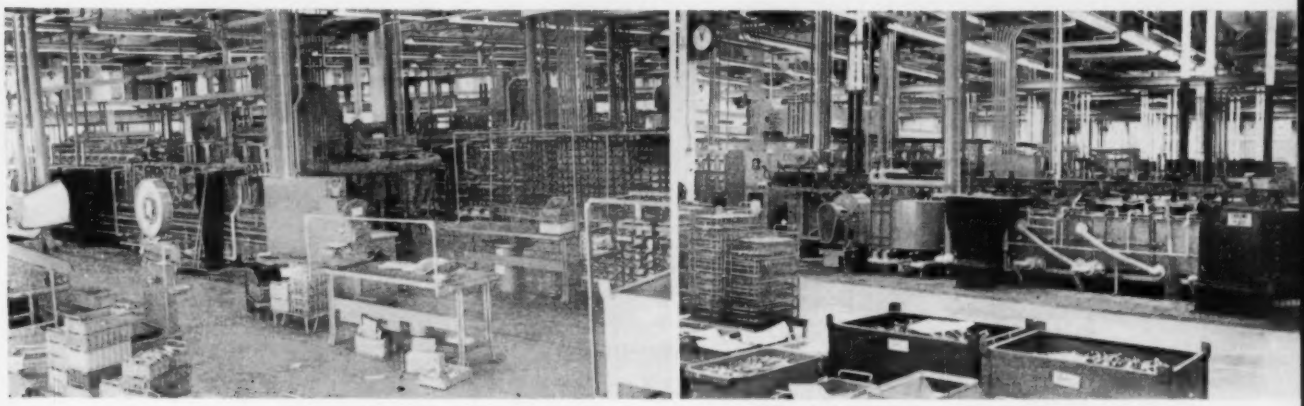


Fig. 2. Typical tank flow regulation assembly.



Plating machines in processing building. Left, south half of the building, right, north half.

PROPOSED METHOD OF TREATMENT AND TREATMENT FACILITIES

General—Building Number 106, where industrial wastes are produced, is located approximately 1600 feet from the industrial waste treatment plant. Allowance for future factory expansion and architectural considerations prohibited closer location of the treatment plant.

The wastes are segregated into chromate, cyanide, and general wastes. One of the first problems involved selection of a pipe suitable for conveyance of the wastes to three underground sumps in Building Number 106. The first considered was rigid polyvinyl chloride plastic pipe. This pipe could not be used, however, because of the relatively high temperature of some of the wastes. After an investigation of Duriron, Durichlor, Fiberglas and Saran lined pipes, it was decided that vitrified clay pipe, with integral joints made of plasticized polyvinyl chloride, would perform satisfactorily and at a lower cost.

The vitrified clay pipe is kept full of water at all times by an inverted pipe loop and appears to be watertight. The pipe loop is necessary to prevent unequal thermal shocks from cracking a partially filled pipe when hot tanks are dumped. Floor drains and vertical pipes feeding the clay pipe are Duriron. Duriron was chosen because it can withstand the abuse the floor drains take and can better absorb the thermal shocks on the partially filled riser. All pipe was hydrostatically tested at 5 psig after installation.

The cyanide and chromate rinse sumps have a maximum capacity of 13,000 gallons each and the general rinse sump 23,000 gallons. Concentrated dumpings are combined with the rinses. The collected rinses and dumpings are pumped at controlled rates to the Industrial Waste Treatment Plant through underground pipes of Schedule 40 rigid unplasticized polyvinyl chloride pipe with solvent cement welded joints backed up externally by a thermally welded bead. The piping above ground on the discharge side of the pumps are of Saran-lined steel. High temperatures are not a problem with wastes leaving these sumps.

The two pumps for each sump are wired to pump alternately or concurrently. The operation may be automatic, with actuation from bubbler type liquid level controllers, or manual. The bubblers are equipped to transmit the levels of these basins to visual indicators on the control panel in the waste treatment plant. Two 40 gpm wet pit centrifugal pumps are used for the cyanide wastes, two 35 gpm wet pit centrifugal pumps for the chromate wastes, and two 125 gpm self-priming centrifugal pumps for the general wastes. The cyanide waste pumps are constructed entirely of cast iron, the chromate pumps of stainless steel Type 316, and the general waste pumps of Durichlor.

Chemical treatment provided involves essentially the chlorine oxidation of cyanides to carbon dioxide, nitrogen and nitrate by-products; reduction of hexavalent chromium to trivalent chromium; and neutralization of the treated chromium and cyanide rinses in conjunction with the untreated general rinses.

Following the chemical treatment the neutralized slurry is clarified. This results in a substantially clear effluent and a sludge which is dewatered and carted away to the city dump.

The plant has been designed to receive flow of liquid wastes sixteen hours per day, five days per week. However, if necessary it can be operated 24 hours per day, seven days per week.

Removal of Cyanide—The cyanide wastes are pumped into a 225 gallon reaction basin which provides a maximum detention of 5.5 minutes, and then flow by gravity to two larger basins in series, each having a capacity of 9300 gallons and providing a maximum detention of 233 minutes at 40 gpm flow. The flow through each basin is upward, with the liquid from the previous basin discharging into a box located at the entrance of the following basin. (See Fig. 3.)

In the first basin, chlorine oxidizes cyanide to cyanate while the *p*H is maintained above 10.0 due to addition of caustic soda. The caustic soda solution is added by a chemical proportioning pump pneumatically controlled by signals originating from a *p*H submersion electrode assembly in the treatment tank. The caustic soda, as a fifty per cent by weight solution, is stored in a 2000 gallon tank inside the treatment building. It is injected at a point downstream of a recirculating transfer pump and upstream of the ejector of the chlorinator. The addition of chlorine is controlled by an oxidation-reduction-potential (ORP) electrode assembly submerged in the body of the liquid being treated.

In the two basins following the first basin, the cyanate ion is oxidized to carbon dioxide, nitrogen and nitrates within a *p*H range of 6.5 to 8.0, as maintained by the controlled addition of caustic soda and chlorine, as above. An ORP electrode assembly submerged in the first basin can be set to control the feed of chlorine into the second basin at a ratio of approximately 1.7 times the feed to the first.

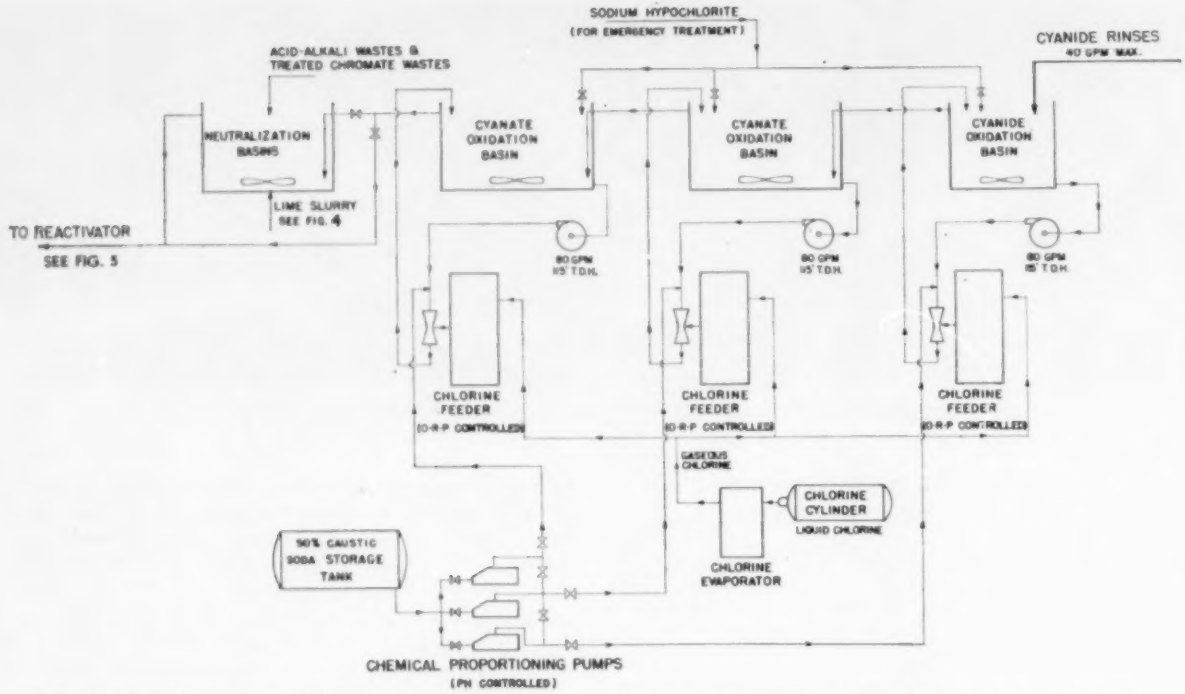


Fig. 3. Flow diagram for cyanide wastes. (1) Gravity piping to treatment basins is so arranged that any basin can be bypassed. (2) Treated cyanide rinses may bypass the neutralization basins. (3) Cyanides may also be batch treated.

The third treatment basin is used only on standby basis for additional treatment if the reaction is not completed in the first two basins. Flow is directed through this basin with automatic controls set to treat if necessary.

Sufficient mechanical agitation is provided in each basin to guarantee thorough mixing of the incoming waste and chemical reagents.

Liquid transfer and recirculation pumps, capable of pumping 80 gpm against a back pressure of 115 feet, have been provided for operation of the chlorine injectors adjacent to the chlorine feeding machines.

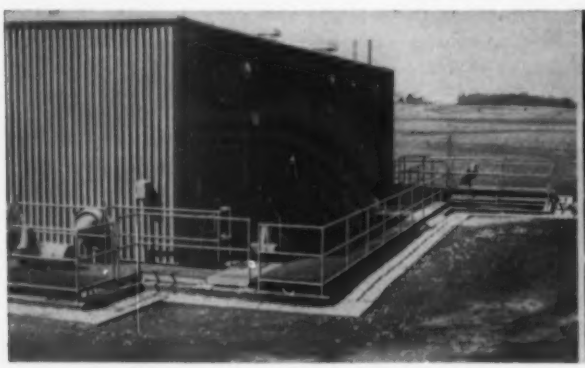
Treated effluent from the cyanate oxidation basins flows by gravity to the neutralization compartment of the solids contact clarification unit.

All basins are piped so that each can be bypassed.

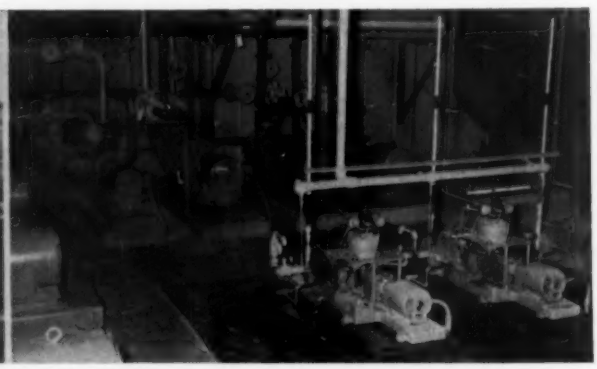
The cyanate oxidation basins are also piped to make it possible to use either of the two cyanate oxidation basins for batch treatment of concentrated cyanide dumpings. The cyanate treatment basins, in this case, are operated on a fill and draw basis, and are drained by 75 gpm centrifugal pumps. For batch treatment a portion of the oxidizing agent can be furnished in the form of a solution of sodium hypochlorite pumped from a 2000 gallon general reagent solution tank by a 25 gpm pump. Therefore, if a solution containing fifteen per cent available chlorine is used, it is possible to feed the equivalent of 37.5 pounds of chlorine per minute instead of a maximum of the 1.4 pounds fed by each chlorinator.

Additional provisions have been made for feeding calcium hypochlorite solution to the flash mixing basins or the neutralization compartment of the continuous settling unit, should cyanides be accidentally found in the general or chromate rinses.

Removal of Hexavalent Chromium—The chromate rinses and dumpings are pumped into two chromate reduction basins in series. Here, while maintaining mechanical agita-



Treatment basins at industrial waste treatment building.



Liquid transfer and proportioning pumps in basement of waste treatment building.

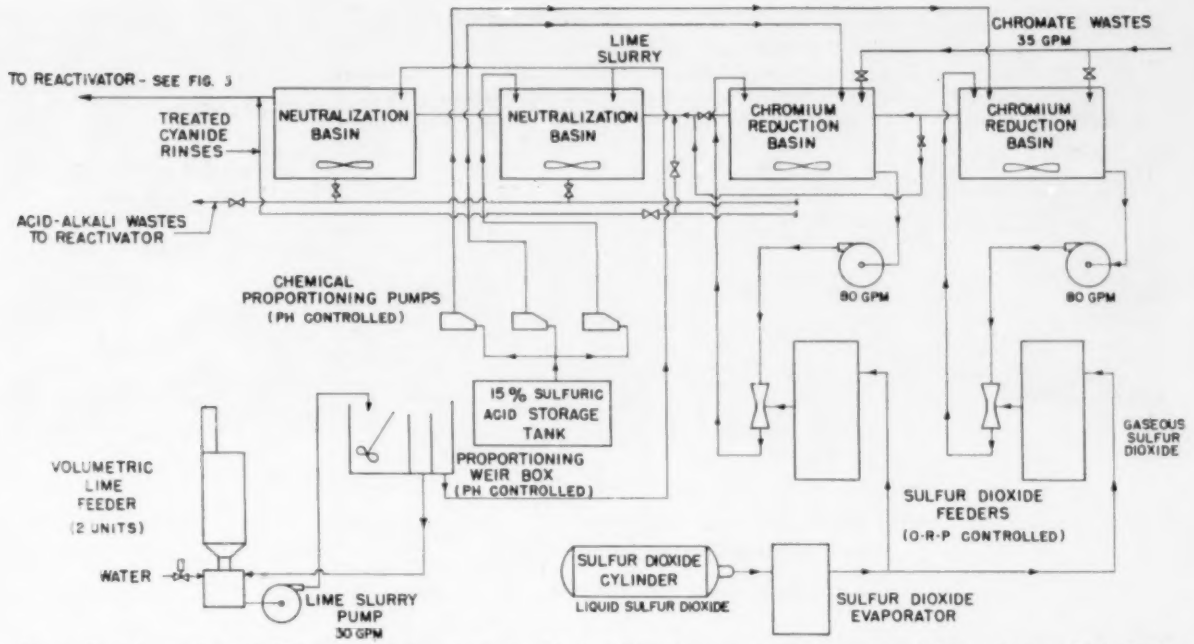


Fig. 4. Flow diagram for acid-alkali wastes and chromate waste. Gravity piping to treatment basins is so arranged that any basin can be bypassed.

tion, they are treated with sulfur dioxide at a *p*H value of approximately 2.

Each basin has a capacity of 3140 gallons and can provide a maximum detention of 89 minutes at a flow of 35 gpm. The first basin is expected to provide complete reduction of the entire hexavalent chromium content of the liquid waste, and thus far has been adequate. The second basin is a standby basin, to support the first basin in emergencies, and for batch treatment of concentrated chromate dumpings.

Sulfur dioxide is fed by sulfonators. Chromate liquid waste is used for operating the injector attached to the sulfonators and is pumped by corrosion resistant liquid transfer pumps.

The addition of sulfur dioxide is regulated continuously, in proportion to the demand, by pneumatic impulses actuated by ORP electrode assemblies submerged in the liquid contents of the two chromate treatment basins.

To maintain the *p*H of the chromate waste at about 2, a fifteen to twenty per cent (by weight) sulfuric acid solution is fed in proportion to the demand by chemical proportioning pumps. These pumps are pneumatically controlled by signals from *p*H electrode assemblies submerged in the liquid waste being treated.

If chromates are accidentally combined with the general and/or cyanide rinses, the chromates are reduced by addition of solid sodium metabisulfite or sodium hydrosulfite or a solution of either reagent to the flash mixing basins or to the neutralization compartment of the solids contact clarification unit. As chromates have frequently been found in the general rinses, the operators have had to resort to use of sodium hydrosulfite, which is effective even at *p*H 8. The sources of the chromates are being found and this problem has largely been eliminated.

The chromium treatment basins are piped so that either basin can be bypassed.

The treated chromium effluent flows either to the flash mixing basins or to the neutralization compartment of the continuous settling unit.

Neutralization of Rinses and Dumpings—Provisions have been made for hydrated lime neutralization of the untreated general rinses, treated cyanide and chromate rinses. This lime is added to one or both of the flash mixing basins, or in the neutralization compartment of the solids contact clarification unit, depending on the requirements. (See Fig. 4.)

The basins have a capacity of 3140 gallons each and a maximum detention time of 14.5 minutes for a 200 gpm flow.

Hydrated lime is fed by volumetric type feeders provided with a slurry mixing chamber. The feeders are controlled proportionately and pneumatically by *p*H electrode assemblies submerged in the two neutralization basins and in the neutralization compartment of the solids contact clarification unit. The control operates a movable weir splitter in a proportional weir box. (SeeFig. 4.)

One feeder is connected to the two flash mixing basins and the other to the neutralization compartment of the solids contact unit. *p*H control can proportion lime to one of the two neutralization basins, depending on which *p*H electrode assembly is connected to the lime feeder.

If the general rinses are alkaline, provisions have been made for addition of a fifteen to twenty per cent sulfuric acid solution by a *p*H controlled chemical proportioning pump. The *p*H control system will either actuate the lime feeders or the sulfuric acid pump, depending on whether the *p*H of the incoming liquid waste is below or above an 8 to 9 range.

Clarification of Neutralized Slurry and Dewatering of Resulting Sludge—The partially or completely neutralized waste enters to solids contact unit, a Graver Reactivator installed in a twenty by twenty foot concrete basin with a side liquid depth of twelve feet. The point of introduction is near the bottom of the upper draft tube, Fig. 5, through the distribution ring. The incoming slurry is mixed with recirculated precipitate. The mixing and recirculation is effected by an impeller inside the upper draft tube. The impeller is driven by a variable speed motor and is capable of recirculating four to six times the design flow to the Re-

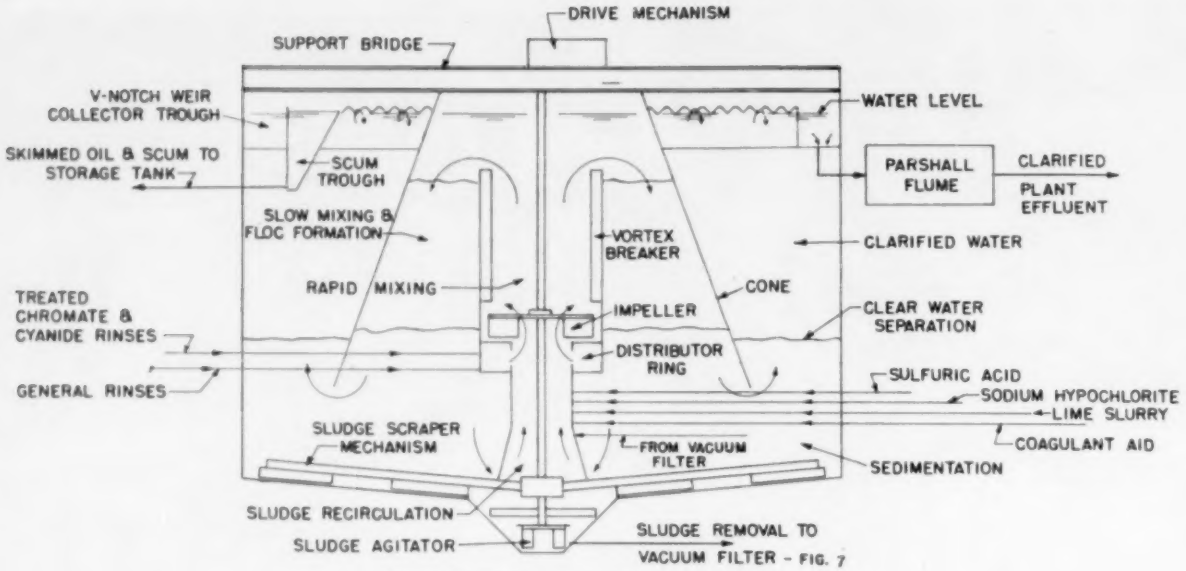


Fig. 5. Reactivator. Composite sectional elevation.

activator. Additional lime is added if called for by signals from a submersion type *p*H electrode assembly.

The neutralized mixture flows over the top of the upper draft tube into the reaction zone of the cone where flocculation occurs. Direction of flow is downward toward the bottom of the cone, thence upward to the clarification zone. Some water is recirculated with the slurry back to the draft tube. Intimate mingling of freshly precipitated solids with incoming solids makes it possible to increase the size of the flocculated particles, thus enhancing clarification.

Skimming facilities are provided for removing oils, greases and floating solids, as shown in Figs. 5 and 6 respectively. The effluent is evenly distributed over peripheral V-notch weirs. The flow rate of the effluent is measured through a Parshall flume provided with a float and means for recording flow rates.

A slowly rotating bottom scraper mechanism moves the settled solids continuously toward the center of the unit into the sludge pit where additional thickening action takes place. Periodic blowoff of the sludge is automatic by means of a timer which can be preset to provide proper frequency in obtaining a relatively concentrated sludge.

In addition to neutralizing agents, Separan NP-10, a coagulant aid, is added to the Reactivator influent in the ratio of approximately 1 to 2 ppm. Few analytical studies have been made on performance of the unit, however, results obtained indicate a suspended solids concentration in the effluent below 10 ppm. The concentration of suspended solids in the sludge leaving the Reactivator appears to be in the range of three to six per cent (30,000 to 60,000 ppm) compared to approximately 1000–2000 ppm in the slurry entering the Reactivator.

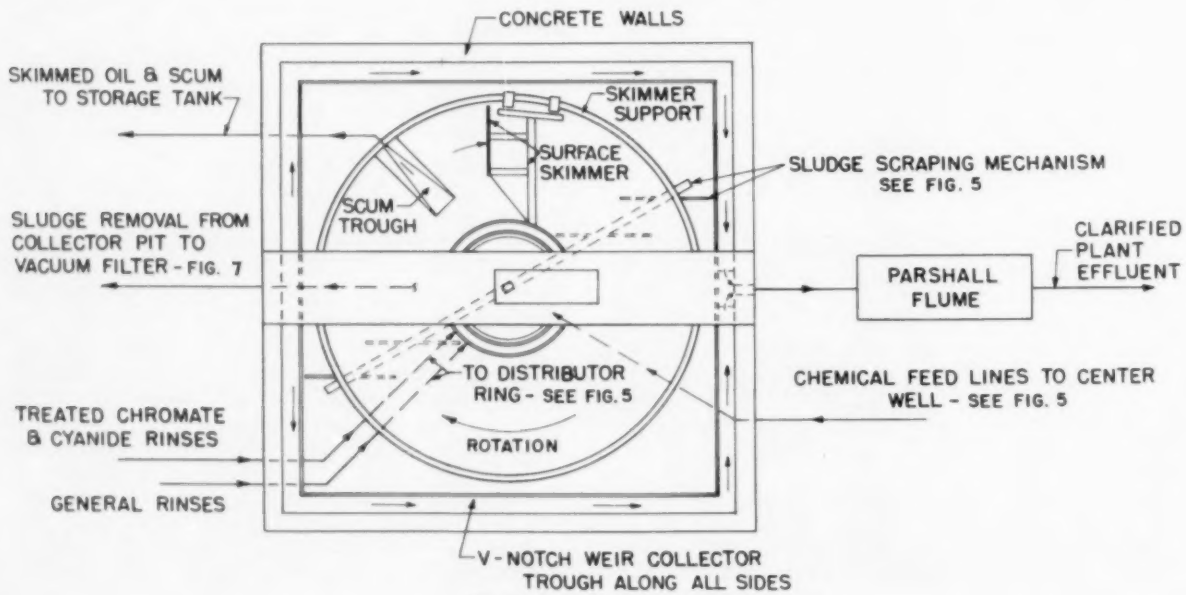
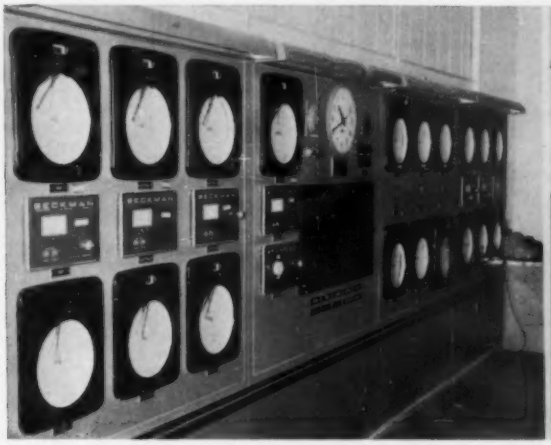
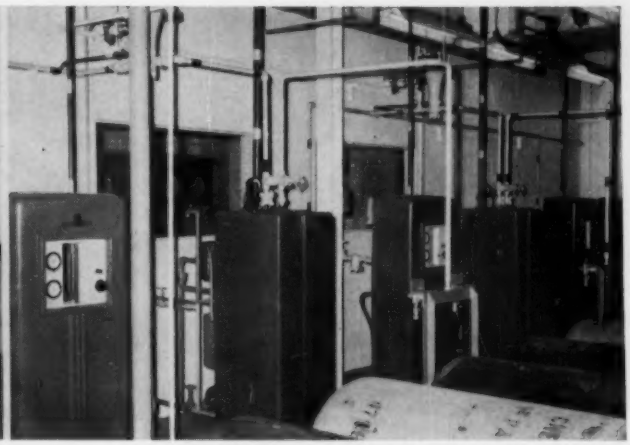

CONCRETE WALLS
SKIMMED OIL & SCUM TO STORAGE TANK
SKIMMER SUPPORT
SURFACE SKIMMER
SLUDGE SCRAPING MECHANISM SEE FIG. 5
SCUM TROUGH
SLUDGE REMOVAL FROM COLLECTOR PIT TO VACUUM FILTER - FIG. 7
CLARIFIED PLANT EFFLUENT
PARSHALL FLUME
TO DISTRIBUTOR RING - SEE FIG. 5
CHEMICAL FEED LINES TO CENTER WELL - SEE FIG. 5
ROTATION
TREATED CHROMATE & CYANIDE RINSES
GENERAL RINSES
V-NOTCH WEIR COLLECTOR TROUGH ALONG ALL SIDES

Fig. 6. Plan view of Reactivator.

SUPERNATANT LIQUID RETURNED



Continuous treatment control panel.



Automatic chlorine and sulfur dioxide feeders.

The settled sludge is intermittently discharged to one of two sludge storage or holding basins, each having a capacity of approximately 4700 gallons. Sludge stored in the sludge holding basins thickens to a suspended solids concentration of ten to twelve per cent. This percentage is greater than expected and may be caused by the dewatering action of the coagulant aid. Any supernatant liquid forming in the sludge storage basin is siphoned out through a swing siphon and returned through 25 gpm centrifugal pumps to the inlet of the Reactivator. Prior to filtration, the thickened sludge is pumped by variable speed air operated Dorr-Oliver diaphragm pumps, each with a maximum capacity of 35 gpm, either directly to a precoat type continuous rotary drum vacuum filter, or through a sludge conditioning tank. In this tank the sludge may be made more readily filterable by the addition of limestone, lime, or some coagulant aid. To date it has not been necessary to use this tank because of high sludge density. (See Fig. 7.)

The vacuum filter has a total filtering area of sixty square feet, with approximately fifty-five per cent of the area submerged. The filter medium consists of synthetic fiber cloth coated with a layer of diatomaceous earth.

The filter unit is less frequently in use than anticipated because it had been designed for a concentration of solids in the settled sludge not to exceed three per cent, as compared to the range of ten to twelve per cent obtained so far.

From October 1958 to July 1959, approximately seventy cubic yards of filter cake were discharged and an additional volume of twenty cubic yards was in the sludge holding tanks. The filter cake contains an average of twenty-five per cent solids. Because of the relatively high consistency of the feed to the filter, filter cake thicknesses of one-half inch or higher are obtained. These thicknesses are too great to be properly dewatered during the air drying cycle. The filter cake is collected in a steel container and periodically discharged by truck to the city dump.

The vacuum filter is located above the sludge holding basins so any overflow of slurry is returned by gravity. The filtrate is pumped to the influent line entering the reactivator.

Saran-lined steel pipes and Saran-lined cast iron fittings and valves are used for the majority of the piping interconnecting the treatment basins along the basement walls. Some of the pipes are of rigid unplasticized polyvinyl chloride (PVC) plastic. Where corrosive conditions on steel surfaces exist, a protective lining of plasticized polyvinyl chloride material has been applied. All pump bases and the immediate area around the pumps and tanks handling corrosive solutions have also been covered with plasticized polyvinyl chloride sheeting. The interior of the concrete treatment basins used for treatment of chromates and neutralization are protected by Amer-Plate, a plasticized polyvinyl chloride sheeting material. The interior of the cyanide and cyanate treatment basins in protected by a 10-mil coating of Tarset,* a coal tar-epoxy coating.

OPERATION OF THE INDUSTRIAL WASTE TREATMENT FACILITIES

The plant is operated by two persons on an eight hour per day shift. Usually the entire daily flow of waste is treated in four hours on a continuous basis, with the exception of the cyanide wastes which are treated on a batch basis. The remainder of the day is devoted to maintenance, pumping sludge, and completing required tests and records. From October 1958 to July 1959, approximately 7,850,000 gallons of waste received treatment in the plant.

It has been necessary to clean conductivity cells located in the processing building once per month for proper operation. The *p*H and ORP cells in the cyanide and cyanate tanks of the treatment plant are cleaned once per week. ORP cells in the chrome basins are cleaned once every two weeks. The *p*H cells in the chrome basins and the *p*H and ORP cells in the clarifier have not needed cleaning to date. All *p*H cells are recalibrated once per day. ORP cells not broken during the interim period are checked every six months or when effluent tests indicate a malfunction.

The plant was placed in operation with the assistance of Graver Water Conditioning representatives who spent ap-

The major equipment and the manufacturers are:

1. Chlorinators, sulfonators and evaporators—Wallace & Tiernan.
2. Transfer pumps for chlorinated and sulfonated solutions—Durcon No. 3 pumps by the Duriron Company, Incorporated.
3. Chemical proportioning pumps—Hills-McCanna Company.
4. Centrifugal wet pit pumps for cyanide and chromate wastes—Lawrence Pump & Engine Company.
5. Self-priming pumps for general rinses—The Duriron Company, Incorporated.
6. Mechanical agitators—Graver Water Conditioning Company, and Chemineer, Incorporated.
7. Lime feeders—B-I-F Industries, Incorporated.
8. Sludge pumps—Dorr-Oliver, Incorporated.
9. Instrumentation—Recorders and Controllers by the Foxboro Company; Electrode assemblies and amplifiers by Beckman Instruments, Incorporated.
10. Vacuum filter—Eimco.
11. Solids contact unit—Graver Water Conditioning Company.

* Pittsburgh Coke & Chemical Co., Pittsburgh, Pa.

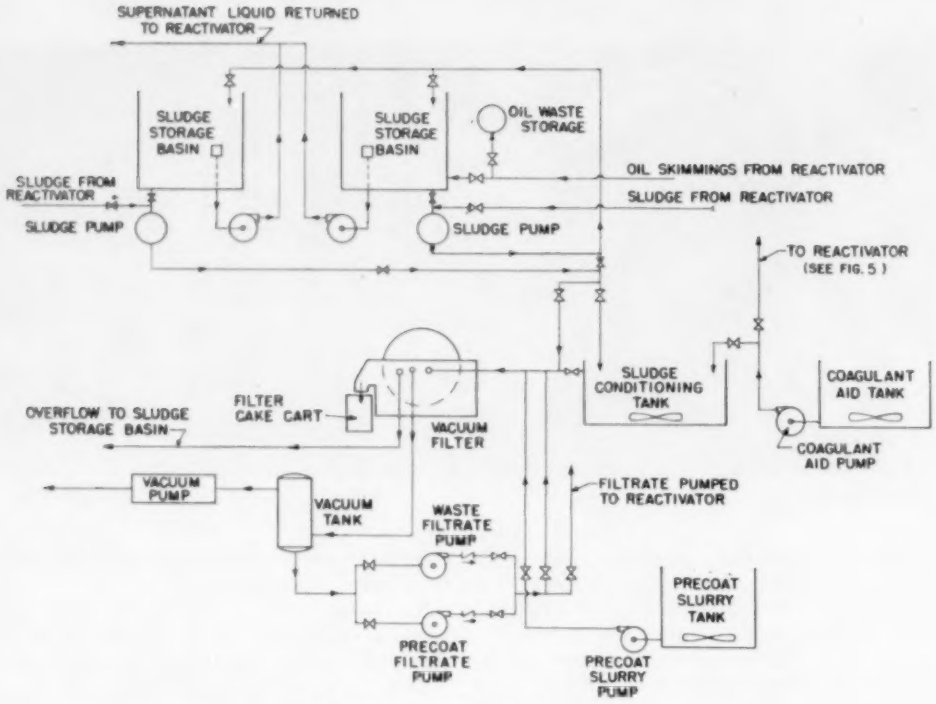


Fig. 7. Sludge filtration flow chart.

proximately five weeks at the site. The only major difficulties experienced were with the operation and maintenance of the electrodes located outside in the treatment basins. The reason for these difficulties is the low winter temperatures encountered in Minnesota. These problems have now been solved satisfactorily.

CONCLUSIONS

It has been shown how conservation of water in the plating department, by use of an automatically controlled countercurrent multiple rinsing system, has resulted in a design flow which utilizes less than one-fourth the water volume previously anticipated. By elimination of wet scrubbing facilities for the exhaust gases from various processing solutions, the load on the waste treatment plant has been further decreased.

The cost of the present waste treatment plant was approximately one-half the bid price for a plant necessary without the adoption of water conservation measures.

The reduction in water usage from 810gpm to our present average use of 50 gpm also results in a 93 per cent saving in municipal billings.

All treatment is generally performed on a continuous basis. The addition of reagents is automatically controlled by means of *p*H and submersion type oxidation-reduction-potential (ORP) electrode assemblies.

A recent analysis of a sample made by the Minnesota Department of Health indicated the treated effluent to have a *p*H value of 7.8, a suspended solids concentration of 5.2 ppm, absence of cyanides, hexavalent chromium and oil, and a total chromium content of 0.22 ppm, 0.18 ppm of copper, 0.19 ppm of cadmium, and 0.13 ppm of nickel. All of these values are well under design maximums.

ACKNOWLEDGMENTS

We wish to acknowledge the assistance of Mr. R. B. Morris Jr., plant engineer, who was instrumental in initiating the water conservation project and gave his full support and encouragement throughout the design, construction, and operation period; Mr. K. Edstrom, manufacturing engineering, and Mr. William Parker and Dr. Walter Wade, technical laboratory, IBM Rochester, for their help in establishing dragout rates, contamination levels, and plating processes; Mr. C. D. Softy, IBM building construction department; Messrs. A. Avian and P. P. Petkoff of Smith, Hinchman and Grylls Associates, Inc., who did the structural engineering work and assisted in the preparation of the drawings; Messrs. W. Yeager and J. Dinkeloo, Eero Saarinen and Associates, who did the architectural design work; Mr. Beldon Keck, manager of the waste treatment plant, IBM Rochester; and for the assistance of Messrs. E. Thiele and J. O'Day of Graver Water Conditioning Company, who, together with the operators of the plant, Messrs. D. Brossoit and D. Wendt, contributed to the success of its operation.

Neil H. Hanson, a registered professional engineer, is employed by IBM as a building engineer of the Rochester Plant. Mr. Hanson was in charge of mechanical design and construction of the Heat Treating and Plating Building. He holds degrees in mechanical engineering and business administration from the University of Minnesota and is a former contractor who holds a Minnesota Master Plumber's license.

Walter Zabban, a chemical engineer by training, is presently a partner with the Chester Engineers, Pittsburgh, Pennsylvania. The firm specializes in the design of water, sewage, and industrial waste treatment facilities. He holds degrees from the University of Louisville and Yale University and was formerly associated with Research Project No. 10 of the AES.

OPTIMIZED METAL FINISHING RECOVERY SYSTEM

by WALTER F. SWANTON*

DURING THE PAST ten years 50 or more installations of varying types for the combined recovery of metal finishing chemicals and the solution of waste disposal problems have been made by the simple expedient of evaporative concentration of drag-out rinse water for return to the process tank. One of the more recent of these installations not only achieved these customary twin objectives, but simultaneously controlled the temperature of a chromium plating bath and so eliminated the need for a separate cooling system. It did this without the use of any supplemental heat, using only the waste heat generated by passage of the electric current in the solution. In other words, one complete package, costing no more than the usual concentrator, served the five following functions:

1. Solved the waste disposal problem for this plating operation.
2. Recovered essentially all of the chemicals formerly lost through drag-out,
3. Maintained the bath at a steady operating temperature,
4. Reduced water consumption for dilution of wastes, and
5. Utilized waste process heat.

This may sound fantastic, but it is really very simple.

UTILIZATION OF WASTE HEAT

Many production line electrolytic operations such as chrome plating and anodizing require such large inputs of electrical power to the solution that they must be cooled to prevent excessive operating temperatures. Either the solution is circulated continuously through an external cooler or cooling coils are immersed in the bath itself.

Use of this waste heat has been ignored in many cases where recovery of plating chemicals from rinse waters is achieved by evaporation. An independent heat source is used to concentrate contaminated rinse waters so they can be returned to the plating bath. Thus, there often exists side-by-side, see Fig. 1, a process bath in which waste heat of electrolysis is dissipated by cooling water and an evaporator to which steam heat and additional cooling water to condense the vaporized water are supplied.

In the new operating procedure, Fig. 2, hot solution is drawn directly from the process bath to a vacuum flash chamber where water vapor is removed and the concentrated, cooled solution is returned to the process tank. Vaporized water is condensed and returned to the last rinse tank from which it cascades through successive rinse tanks, counter-flow to the work, back to the process bath.

A material balance around the plating, rinsing and recovery systems shows only water dragged in from the pre-rinse equals water dragged out from the last rinse, and plating chemicals added equals metal deposited on the work, plus minor losses due to undesirable chemical reactions, spillage, etc., since drag-out of chemicals from the final rinse is negligible.

A heat balance around the system shows electrolytic heat input, Qe, equals the sensible heat of condenser water out, where as in Fig. 1, the sum of electrolytic heat plus evapora-

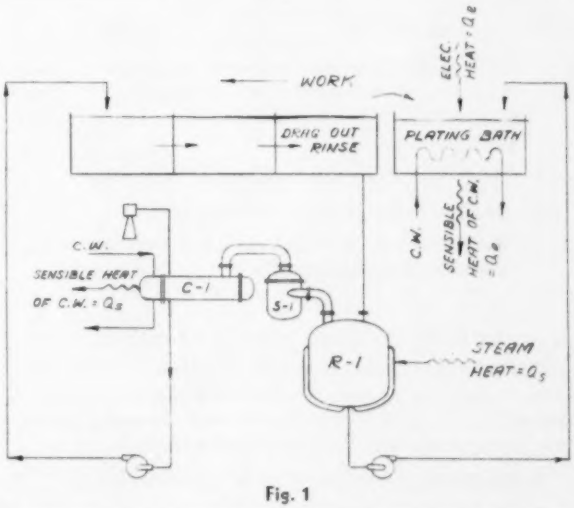


Fig. 1

* The Pfaudler Co., a division of Pfaudler Permutit Inc., Rochester 3, N. Y.

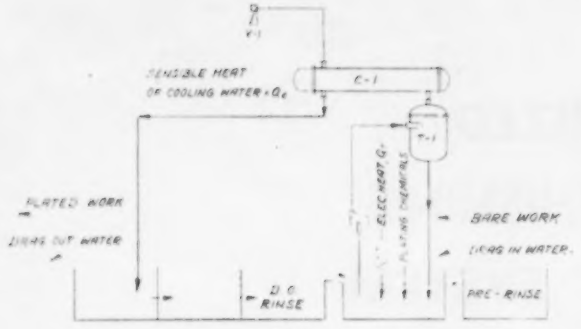


Fig. 2

tor steam heat equals the sensible heat of process cooling water plus sensible heat of condenser water.

A CASE HISTORY

The principle of this system[1] has been confirmed by an installation, made in 1957.

Hot chromic acid solution at 120F is drawn by a combination of vacuum and pumping directly from the plating bath through a 2 in. line to an evacuated flash chamber, T-1, above the plating tank. A fraction of the water content of the solution flashes into vapor, adiabatically cooling the remaining solution to 92 F. The cooled solution returns to the plating bath through a barometric leg.

No controls are used in this installation since the process is essentially self regulating. No supplementary steam for vaporization is required. The 28.5 in. of Hg vacuum is created by a low level vacuum pump which used water recirculated by a pump through an ejector. Thus the only utilities required for the system are electrical power for the pumps and cooling water for the condenser. This latter represents little additional cost since almost as much had been required previously for cooling the bath. Operating labor is negligible since only a few minutes are required in the morning to start the process and in the evening to shut it down.

Savings realized were:

1. A 90 per cent reduction in chromic acid formerly lost by dragout and decreased water consumption for waste dilution, equivalent to an estimated saving of $125.00 per 8-hour day.
2. Number of rejects was reduced by 50 per cent
3. Quality of chrome plate improved, and
4. The number of analytical checks of bath strength required was reduced fourfold.

OPTIMIZING THE RECOVERY SYSTEM

While this installation represents an advance over previous ones, it does not incorporate all the steps needed to make it the ultimate or optimized system which is illustrated by Fig. 3. This system offers all of the following benefits:

1. Drastically reduces pollution of waste waters,
2. Recovers process chemicals,
3. Provides start up heating and operating temperature control, both heating and/or cooling,
4. Reduces water consumption by reuse of distillate for rinsing,
5. Utilizes waste process heat, if present, and
6. Maintains purity of the process solution (optional).

Briefly its operation is as follows:

1. Process solution (chrome, nickel or cyanide) at its operating temperature is drawn by vacuum, or by vacuum and pumping, from the open process tank through a preheater, C-2, (if required) into a flash chamber, T-1.
2. The excess heat in the solution, which was added in the preheater (and which may be inherent in the process) is dissipated by flash vaporization in T-1.[1]
3. The pressure (absolute) in T-1, which determines the temperature to which the process solution is cooled by adiabatic flashing, is controlled by bleeding more or less air into the evacuated system based on the temperature of the process bath.[1] If the temperature of the process bath is below its desired operating level, the controller TC-1 opens the aid "in-bleed" valve TCV-1 causing the absolute pressure within the system to rise and a higher flashing temperature, with slightly less boil-up. If the temperature of the process bath is above its desired operating level, the controller closes the air "in-bleed" valve causing the absolute pressure to fall and lowers the flashing temperature.
4. Water vapor flashed in T-1 passes through a demister in the top head of T-1 to the surface condenser, C-1.
5. Distilled water condensed in C-1 is returned to the final rinse tank from which it cascades back to the process tank completing the cycle.
6. The evaporative flashing or boil-up rate of the system is controlled by the conductivity of water in one of the rinse tanks. Should the conductivity in this rinse tank become too high, indicating that the counter flow rinse rate is not high enough, the steam flow to the preheater is increased. This increases the heat input to the preheater and in turn increases the rate of vaporization in T-1, the flow of distilled water to the rinse tanks, and the counter-current flow rate back to the plating bath.
7. If impurity build up in the bath is a problem, the process stream (or a portion of it) can be passed through a purifier on its way back to the bath. This removes inpurities which would normally be removed by dragout. The type of purification used will depend, of course, upon the nature of the process. In almost every case a filter will be required. In addition, trivalent chromium can be removed from chrome solution by ion exchange, foreign cations and organics from nickel solutions by electrolysis (dummying) and/or activated carbon, and carbonates from cyanide solutions by cold trapping.

This, in brief, is the Optimized Metal Finishing Recovery System. In general, two types of arrangements are en-

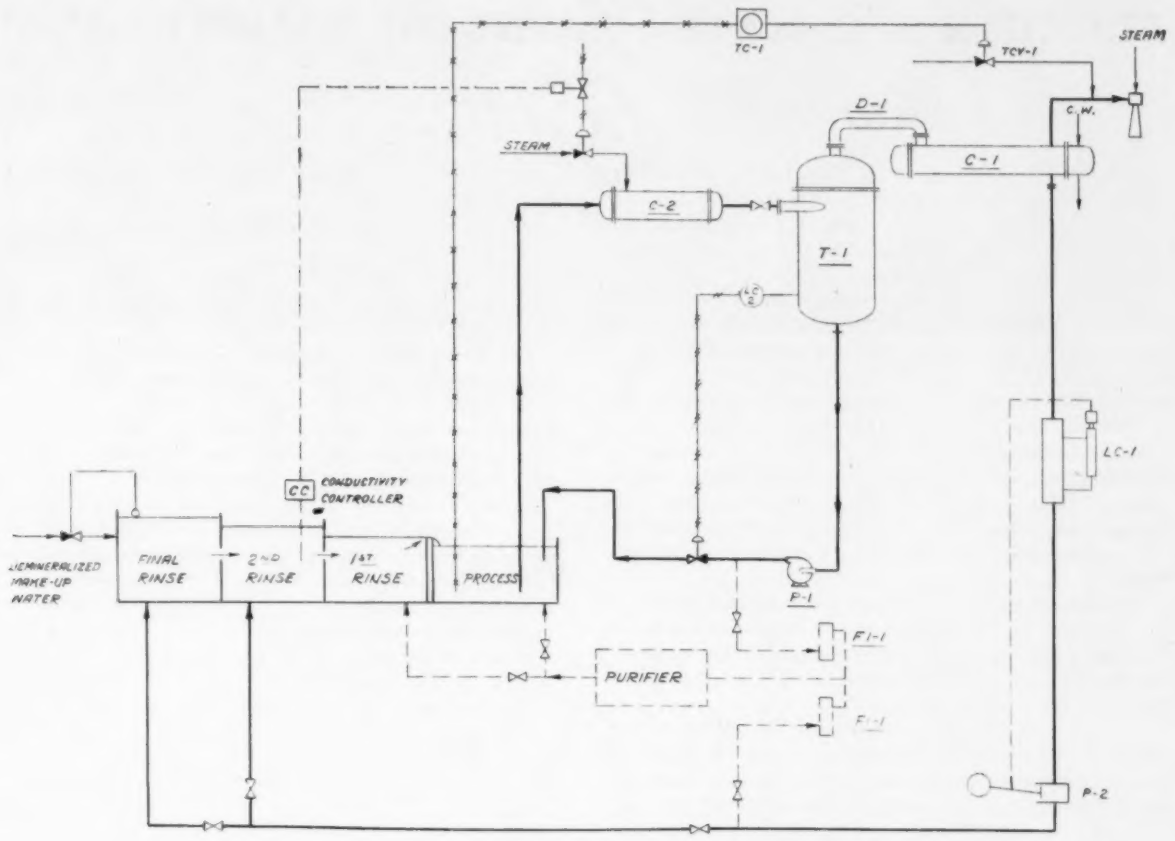


Fig. 3

countered—vertical and horizontal. In the vertical arrangement the preheater, flash chamber and condenser are located above the process tank. With this arrangement the flash tank need be not more than 35 feet above the process tank. In the horizontal arrangement the system will be on the same floor level as the process bath.

The selection of suitable materials of construction is, of course, a most important part of the system design, but is not discussed in this article.

If losses to ventilation system are significant, they can be scrubbed from the ventilating air and returned to the first or dragout rinse for recovery in the same way as dragout.

In this brief description of a system, which for the first time combines many functions which have traditionally been handled independently, many details have been omitted. These details are most important, of course, in obtaining a workable system, but they are not difficult or startling. The major objective of this article has been that of introducing and describing concepts which, although partly proprietary offer promise of such economics in operation of metal finishing processes that it is difficult to see how they have been deferred so long and how anyone will be able to complete successfully in the near future without adopting them.

REFERENCE

[1] U.S. 2,853,442. W. F. Swanton, assigned to The Pfaudler Co.

Walter F. Swanton graduated in 1933 from Massachusetts Institute of Technology with a BS degree in chemical engineering and in 1947 received an MS degree in chemical engineering from the University of Rochester. He is a licensed professional engineer in New York. Prior to joining The Pfaudler Co. in 1950 he spent 8 years in college teaching, 6 years in engineering design, and 3 years in laboratory work.

His teaching experience included a two year course in electroplating and metal finishing at the Rochester Institute of Technology. In 1952 he was awarded, jointly with E. W. Neben, the Logozzo Award for the best paper of 1951 on chromium plating. In 1950, he was secretary of the Rochester Branch of the AES.

More recently he has been responsible for designing systems for the recovery of plating wastes, chemical process plants, and atomic energy application. He served on the research committee of the American Institute of Chemical Engineers and is currently a member of an AICHE subcommittee investigating improved means for technical information storage and retrieval.

ALKALINE CHLORINATION OF CYANIDE WASTES AND REDUCTION OF CHROMIUM WASTES WITH SULFUR DIOXIDE*

by JOSEPH L. BEALS**

THE GROWTH OF INDUSTRY, and in particular the plating industry, has created serious problems in the treatment and disposal of industrial wastes. Along with this natural growth, the general tendency of industry to centralize operations has complicated the situation.

The pollution and contamination of waters are of vital interest to a number of regulatory agencies, special interest groups, and in many instances to the general public. The preservation and maintenance of our water resources is the primary concern regardless of the particular interest involved.

This will deal with two of the most widespread waste problems in the plating industry. These are the disposal of cyanide wastes, and the disposal of chromium plating wastes. Although these two types of waste often are discharged from the same plant they will be treated as separate problems as two entirely different processes are involved in their treatment.

It is recognized that systems other than those described here are used to treat these wastes, however, it is believed that when the requirements of space, equipment, total expense, safety and effectiveness of treatment are considered that these processes will prove best.

The intent of this presentation is not to delve into the technical aspects of these treatment processes. It is to convey to those not yet confronted with serious treatment problems, an idea of the general processes involved.

ALKALINE CHLORINATION OF CYANIDE WASTES

Neither the process, nor the equipment involved, in treating cyanide wastes with chlorine in alkaline solution need be considered complex. The treatment consists either of the oxidation of cyanide compounds to cyanate form and the further destruction of the cyanates, or simply the oxidation of the cyanides to cyanates. The choice between these two treatments is dependent upon the requirements of the particular sewage system or receiving waters.

* Presented to the San Francisco Branch, American Electroplaters' Society, February 12, 1959.

** Division Representative, Wallace & Tiernan Incorporated, San Francisco.

There are two chemical reactions which are important to cyanide treatment.

Cyanide to Cyanate:

$$2Cl_2 + 4NaOH + 2NaCN \rightarrow 2NaCNO + 4NaCl + 2H_2O$$

Cyanate Destruction:

$$3Cl_2 + 6NaOH + 2NaCNO \rightarrow 2NaHCO_3 + N_2 + 6NaCl + 2H_2O$$

Causing these reactions to take place primarily requires adequate holding and recirculation and methods of *p*H adjustment and chlorine application.

Two general methods are used to accomplish the treatment. These are either a flow through type or batch process. The batch system lends itself to both processes whereas the flow through system is normally restricted to oxidation to cyanate form and not employed in the total destruction of both cyanides and cyanates.

The flow through system requires a tank to aid in minimizing fluctuations in waste flow, a treatment tank into which the waste flows, or is pumped, at a constant rate, a sodium hydroxide (caustic) feeder, and a chlorinator. The caustic feeder serves to maintain a *p*H of 8.5–10.0. It should be noted here that wastes, prior to treatment, are often of *p*H value greater than 10.0. In this case caustic is still necessary since the addition of chlorine will cause the *p*H to be reduced.

The chlorinator performs the function of metering the chlorine gas and dissolving it in a quantity of water. The water supply for the chlorinator may be supplied by means of a booster pump, the suction of which is placed in the waste holding tank. An outside source for this water may be used if desired.

If your particular requirements demand the removal of metallic solids, a settling tank should be installed downstream from the treatment tank. A typical flow through system is illustrated in Fig. 1.

The batch system, which is employed for cyanide and cyanate destruction, requires an additional holding tank which may be filling while the other tank is being treated. This type of treatment is most desirable for complete oxidation of cyanides and cyanates since it enables operating personnel to attain the better control required. The batch is treated without the addition of waste during process. A typical batch system is illustrated in Fig. 2.

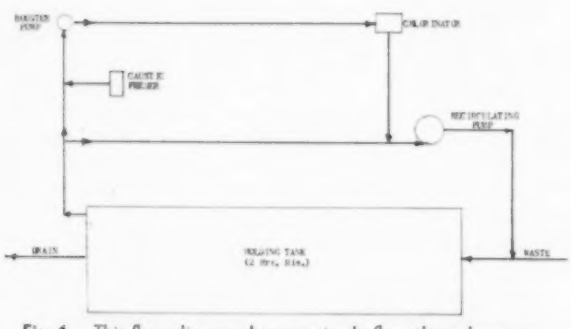


Fig. 1. This flow diagram shows a simple flow-through system in which cyanides are oxidized to cyanates and a partial destruction of cyanates may occur. This system may be adapted to existing equipment by using the first rinse tank as the holding tank.

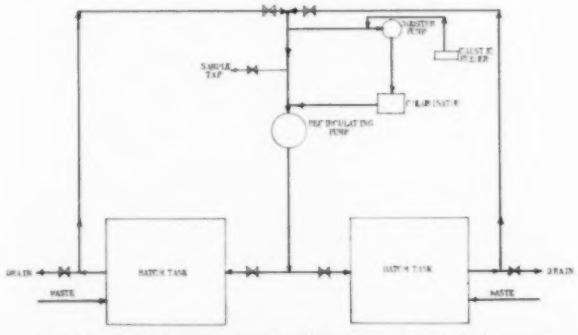


Fig. 2. In this system two batch tanks are treated alternately with the same recirculating and chemical equipment. This sys em gives good process control since each batch may be treated according to its individual requirements. Complete destruction of cyanates may be easily accomplished with this type of treatment.

Fig. 3. A 2000 lb/day chlorinator installed at a large plating plant for the treatment of cyanide wastes. This unit is automatically controlled by the equipment illustrated in Fig. 4.

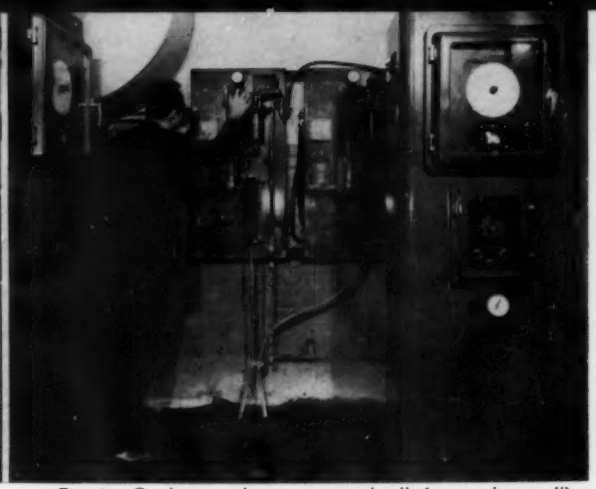


Fig. 4. Oxidation-reduction potential cells (mounted on wall) detect the quality of treated wastes. The ORP recorder-controller (right foreground) receives cell signals and controls the application of chlorine to the treatment process. Automatic pH control is used to regulate caustic addition.

The complete treatment process differs from the partial treatment (cyanide to cyanate) in that more time, chlorine and caustic are required.

Chlorine and caustic equipment may be procured in a variety of capacities to suit any quantity of waste. Control of treatment may be by manual methods, or may incorporate automatic *p*H control for caustic addition and automatic oxidation-reduction-potential (ORP) control for chlorine application. ORP cells and recorder-controller, at a large plating plant, are illustrated in Fig. 3. This type of equipment gives maximum efficiency in control and can save a considerable amount in both treatment chemicals and manhours.[1]

Many factors that relate to secondary problems which are not universal to the industry as a whole, cannot be discussed here. Problems of space, separation of waste types, and applicable equipment must be approached on an individual basis. If particular problems do not appear to be simple ones, it is suggested that competent advice be sought.

CHROMIUM REDUCTION WITH SULFUR DIOXIDE

Chromium wastes containing what is referred to as hexavalent chromium, or chromic acid (H_2CrO_4) cause undesirable contamination of sewage systems or receiving waters.

Though the physical requirements for treating chromium wastes are similar to those for cyanide treatment, the reactions involved are those of reduction instead of oxidation.

This process consists of adding sulfuric acid to lower the *p*H to 2.0–2.5, holding for about 60 minutes to equalize fluctuations in flow and concentration, a reaction tank where a sulfur dioxide solution is added to cause the following reaction:

$$3SO_2 + 2HCrO_4 \rightarrow Cr_2(SO_4)_3 + 2H_2O$$

At this point, the absence of the typical yellow color of chromic acid gives good indication that all chromium is now in the trivalent form.[2]

To remove the trivalent chromium, the *p*H is raised to 8.5 by adding lime or caustive and the chromium is precipitated as chromium hydroxide. If lime is used for this *p*H adjustment, some calcium sulfate will also be precipitated. The waste then passes to a two hour settling tank where precipitated solids are drawn from the bottom.

If the recovery of chromium from the settled sludge is economically practical, caustic should be used for the final *p*H adjustment as no additional precipitate is formed, as with lime.[2] Where recovery is not practical, the sludge is usually concentrated by evaporation and dumped or buried.

Though the flow through system is adequate in many cases, the use of a batch treatment process may be used where the standard of reduction is necessarily high. As with cyanide, the batch system allows more accurate control of chromium removal.

Control at the two points of *p*H adjustment may be manual or automatic. Control of sulfonation may be controlled manually or with ORP control.

Additional factors should be considered in designing either a cyanide or chromium treatment installation. Pumps, piping and tanks should be constructed of materials resistant to attack by the solution being handled. Tanks should be adequately baffled to prevent short-circuit flows and give adequate treatment time. Recirculating pumps should be used in holding tanks when additional equalization of flow and concentration is required. All equipment should be sized to allow for increased flows, or the possibility of more stringent effluent standards.

It should be noted in closing, that the systems described and illustrated here are presented as an indication of the requirements for treating chromium and cyanide wastes, and not as strict rules for achieving the desired end results. Many existing, and effective, treatment systems could not be recognized as such by casual observation. The primary aim of these treatment systems is to cause the indicated reactions to take place. The particular mechanical features of the processes, as long as they are in keeping with sound practices, are of minor consequence.

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[1]Patton, W. G., "Dual Disposal System Fully Neutralizes Plating Wastes," Iron Age, May 1955.

[2]Anon., Vol. 5, No. 4, Chlorination Topics (April 1952).

Joseph L. Beals is a native of Oregon and was graduated from Oregon State College in 1949 with a BS degree in science. He served with the U. S. Army, Infantry during World War II. He has been with Wallace and Tiernan since 1953, serving two years of this time in Portland, Oregon. He is presently their division representative in San Francisco. He is a member of the San Francisco Branch of the American Electroplaters' Society.

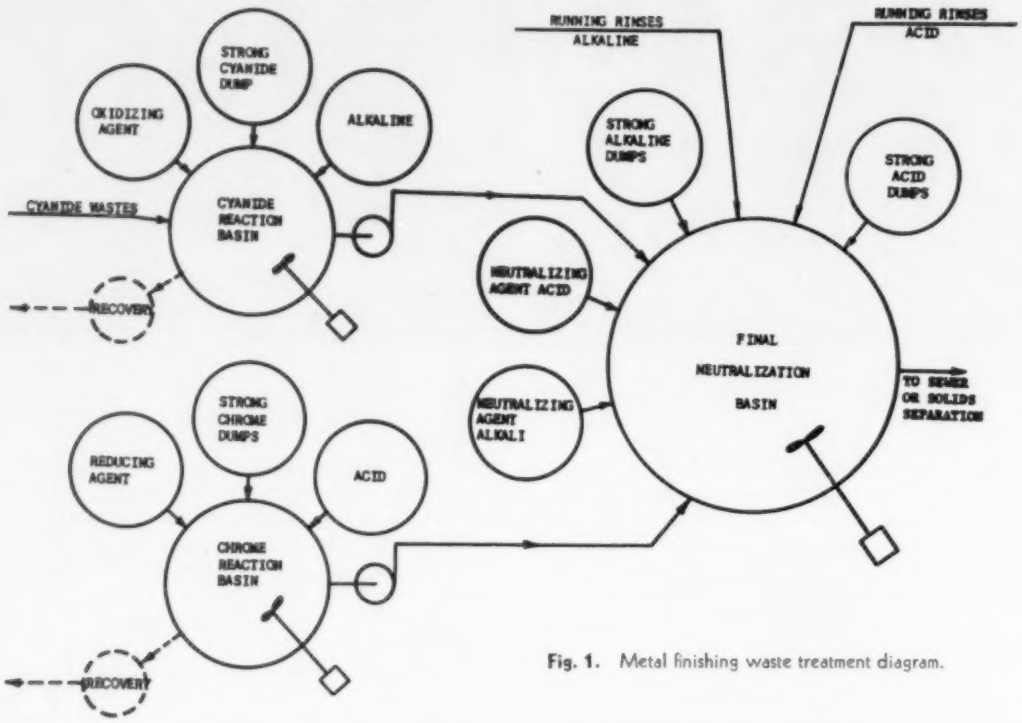


Fig. 1. Metal finishing waste treatment diagram.

HANDLING WASTE SLUDGES

by J. F. ZIEVERS and C. W. RILEY*

CERTAIN APPROACHES TO THE HANDLING of neutralized metal finishing waste sludges and of certain filterability data on metal hydrates are presented here. This paper does not discuss waste treatment and neutralization plant design. Background on these phases of waste treatment are to be found in references 1 through 22.

In a complex metal finishing waste treatment system such as the one illustrated in Fig. 1, cyanide waste residues, after the cyanide has been destroyed, are sent to the final neutralization basin. Chrome wastes, after reduction, are also sent to the final neutralization basin. Running acid and alkaline rinses are sent to the basin. Strong acid and strong alkaline dumps are slowly metered to the final basin. Good planning involves the blending and matching insofar as possible, of acid and alkaline dumps to reduce *p*H shock. Final *p*H on the neutralization basin is adjusted by the addition of acid or alkaline neutralizing agents such as hydrochloric or sulfuric acid if alkalies are in excess, and lime or soda ash for excess acid. Depending upon the dictates of the pollution control authorities, final *p*H in the neutralization basin will be about 7.

In the treatment system illustrated in Fig. 1 state toxicity requirements have been met. State requirements concerning suspended solids still have to be considered. There are at least six possible answers to the suspended solids problem. They are:

(1) Dumping the neutralized waste down the sewer;
(2) Lagooning the wastes;
(3) Clarifying and lagooning the wastes;
(4) Clarifying the wastes followed by filtering in vacuum filters;
(5) Clarifying the wastes and centrifuging;
(6) Filtering the wastes in direct pressure filters.

From the metal finisher's standpoint, disposal of neutralized wastes by dumping them down the sewer is by far the cheapest and most desirable method of disposal. It may be possible that in any specific metal finisher's case, this method can be employed. If so, it should be employed. Looking toward the future, however, the probability is that as pollution control enforcement progresses this will not be possible.

Before passing on to the next simplest technique, note that the relative space requirement of this technique has been designated as 1. This is based on the size of the final neutralization or treatment tank only. It does not take into account treatment circuits up stream, such as cyanide chlorination, chrome reduction, etc. These will vary with each plant's production and are independent of the final handling of the sludges. It should also be noted that in determining the related space requirement for all of the methods of handling waste sludges, the finally neutralized waste is assumed to have a suspended solids concentration of 500 ppm.

After the possibility of dumping down the sewer, the method of disposing of neutralized wastes which employs the

* Vice President and Director of Technical Services, respectively, Industrial Filter and Pump Mfg. Co., Cicero, Illinois.

least amount of equipment is that of lagooning. In this technique the neutralized wastes are pumped to a large lagooning area which has been prepared in advance. In the lagoon, through the process of sedimentation and decantation, the suspended solids finally settle to the bottom and the clear liquid is drawn off and sent to stream or sewer. It is difficult to judge the relative cost of such a system since land values vary so greatly in various parts of the country. Relative space requirement, compared to the first system, is about 140.

From the standpoint of liquid solid separation, the feasibility of lagooning is problematical. The so-called "clears" are at best slightly turbid and in their worst condition are completely unacceptable. As the lagoon fills with sludge the efficiency of liquid-solid separation decreases. Variations in rainfall and temperature can turn the lagoon into a worse headache than the original sludge problem itself. In addition, periodically the lagoon either must be cleaned out, or the land given over to that lagoon must be written off and a new lagoon must be made. In summary we may say that lagooning is a technique which has been used to a great extent in the past, but in more recent years, because of rising land values greater public attention to plant appearances and more stringent requirements on effluents, lagooning has shown numerous draw-backs. Fig. 2 illustrates lagoon area requirements under certain conditions.

Fig. 3 describes disposal of neutralized wastes by means of clarification followed by lagooning. Relative space requirement in this case is about 83. Wastes from the final neutralization basin are pumped to the clarifier. They may or may not be treated additionally with flocculating agents. The underflow or heavy portion of liquid in the clarifier is sent to the lagoon. The clears or overflow from the clarifier are sent to the sewer or stream. The size of the lagoon required depends upon efficiency in the clarifier. In making up exhibits it has been assumed that the clarifier will be able to discharge an underflow that is at least 5 per cent solids. Because of the much heavier concentration of solids reaching the lagoon, the separation of liquids from solids is a much slower process. However, since the flow reaching the lagoon from the clarifier is much less than the total waste flow, a lagoon area approximately half as large as that required when neutralized wastes are discharged directly to a lagoon can be used. This technique is employed presently in a great many plants. It is a proven technique. Relatively it requires a good deal of space and is quite expensive.

Fig. 4 illustrates disposal of neutralized wastes by means

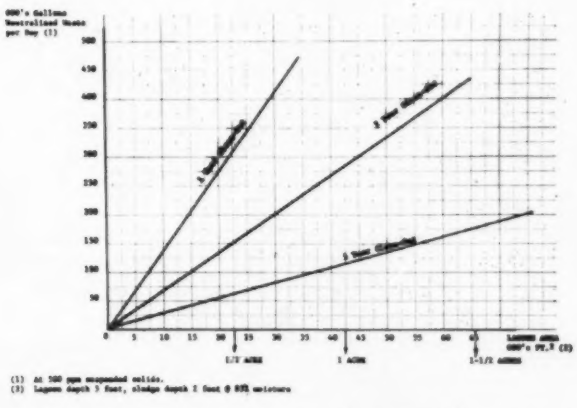


Fig. 2. Lagoon area requirements. Top curve indicates one-year clean-out. Center curve, two-year clean-out. Bottom curve, five-year clean-out.

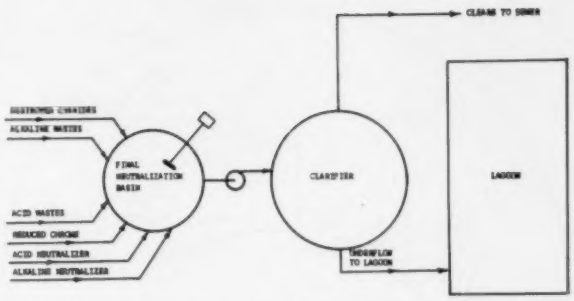


Fig. 3. Clarifier plus lagoon. Relative space requirement 83.

of clarification followed by vacuum filtration. In this system, flows from the final neutralization basin are pumped to the clarifier. Clears from the clarifier are sent to the sewer or stream. Underflow from the clarifier (approximately 5 per cent solids) is sent to a vacuum filter for dewatering. Filtrate from the vacuum filter is sent to sewer or stream, and cake from the filter is sent to the dump. Relative space require-

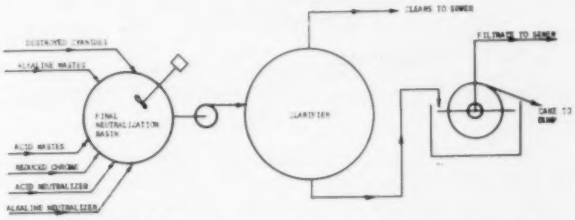


Fig. 4. Clarifier and vacuum filter. Relative space requirement 16.

ment for such a system is 16. From an equipment cost standpoint this is probably the most expensive solution to the problem. From a space requirement standpoint it can probably be termed a middle-of-the-road answer. Operating costs will vary with the composition of the final neutralized

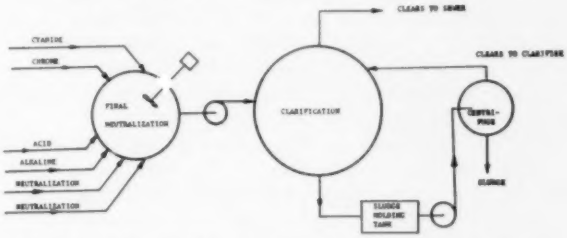


Fig. 5. Clarifier plus centrifuge. Relative space requirement 17.

wastes. It should be noted here that direct vacuum filtration, without preliminary settling, is generally not considered feasible.

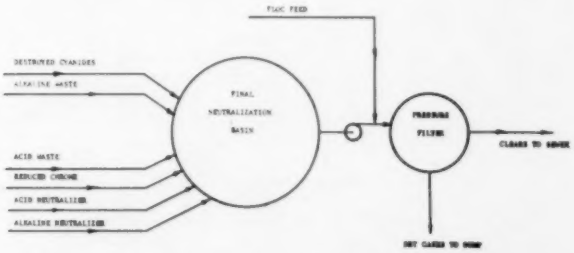


Fig. 6. Direct pressure filtration. Relative space requirement 2.5–3.0.

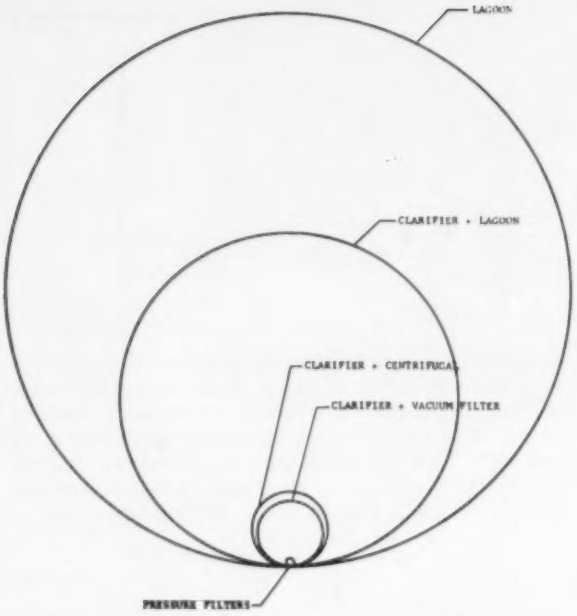


Fig. 7. Relative space requirements of various sludge handling techniques.

Fig. 5 illustrates clarification followed by centrifugation. In this system, flows from the final neutralization basin are pumped to the clarifier. Clears from the clarifier are sent to sewer or stream. Underflow from the clarifier is sent to a sludge receiving tank. From the sludge receiving tank it is pumped to a centrifuge; the spin-off from the centrifuge is returned to the clarifier and sludge from the centrifuge (approximately 80 per cent moisture) is trucked away or sent to a lagoon. Relative space requirement in this case (assuming that the 80 per cent moisture sludge is trucked away or otherwise disposed of) is 17. If it is decided to lagoon the 80 per cent moisture material for further dewatering, space requirement will be considerably higher. This is a relatively expensive answer to the problem and the final product (80 per cent moisture) really has not been sufficiently dewatered for lowest disposal costs.

The next possibility for disposing of neutralized wastes is that of direct pressure filtration. This is illustrated in Fig. 6. In this system neutralized wastes are pumped directly to a pressure filter. Additions of flocculating agents may or may not be necessary. The clears from the filter are sent directly to sewer or stream. The cakes are blown with air and are discharged in "dry state," containing perhaps 50 per cent moisture. Relative space requirement for such a system is 2.5 to 3. Relative cost of such a technique will depend upon the value that is placed on land used for lagooning purposes as an alternative. However, it may be stated that, with the exception of dumping down the sewer, or direct lagooning, pressure filtration is the least expensive method of handling waste sludges.

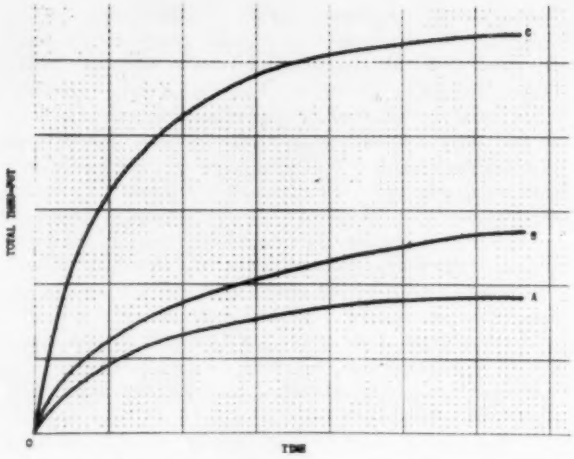


Fig. 9. Comparative filterability of a metallic hydrate with various neutralizers.

With the exception of direct pumping down the sewer, disposal of neutralized wastes by direct pressure filtration is perhaps the best answer. It has the smallest space requirement (see Fig. 7). The effluent from such a system is absolutely clear. If properly operated the finally resulting waste cakes have the least moisture content of any of the alternative systems. (See Fig. 8).

Approximately two years were spent developing techniques for conditioning neutralized waste sludges for pressure filtration, and in developing pressure filtration equipment designs specifically for handling such flows. The following group of exhibits illustrate some of the results of research on the filterability of neutralized metal finishing wastes.

Fig. 9 illustrates the comparative filterability of a metallic hydrate with various neutralizers. As can be seen from the

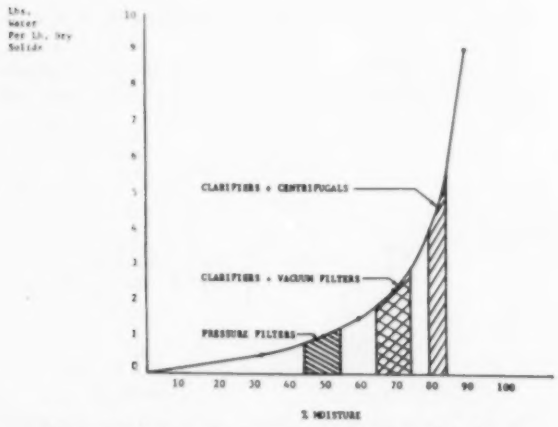


Fig. 8. Relative moisture content of dewatered sludges.

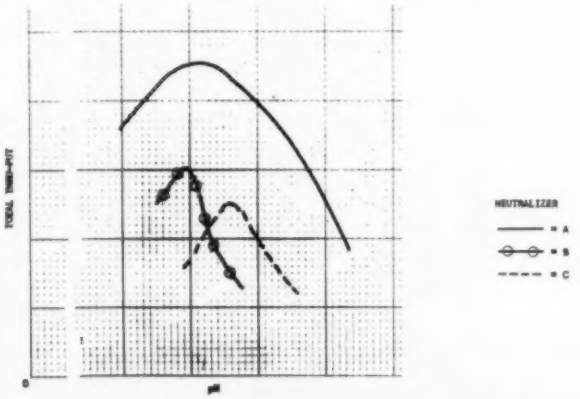


Fig. 10. Effect of pH on filterability.

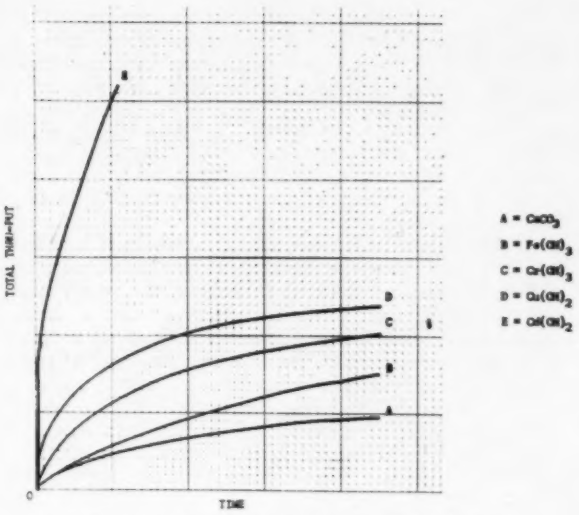


Fig. 11. Filterability of various metallic sludges

curves, the choice of neutralizer has a considerable bearing on the ease with which the finally neutralized wastes can be filtered. In designing a waste treatment system this data must be used as modified by the relative delivered costs of the possible neutralizers, and as modified by the relative size of the resulting filter station required with each of the neutralizers, and the period of years in which the waste treatment plant is to be amortized. The fact is that for any specific set of operating conditions there is a best neutralizer for metal finishing wastes when preparing them for pressure filtration.

The *p*H of the finally resulting liquid in the neutralization basin has a considerable effect on the filterability of the wastes. This is illustrated in Fig. 10. In Fig. 10 we can see as we did in Fig. 9 that one of the neutralizers is best, but with each of the neutralizers covered by this exhibit, there is an optimum *p*H range. The *p*H range is generally the same for all neutralizers in any given set of conditions. In this particular illustration the optimum *p*H range is from 8 to 8.7. From this illustration it may be inferred also that operating a *p*H higher than necessary for best filterability is expensive from the standpoint of the size of the filter required, since filterability falls off quite rapidly after the optimum *p*H range is reached, thus making necessary a larger filter unit.

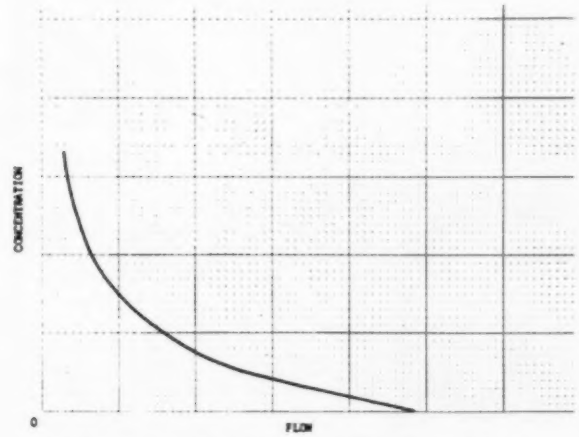
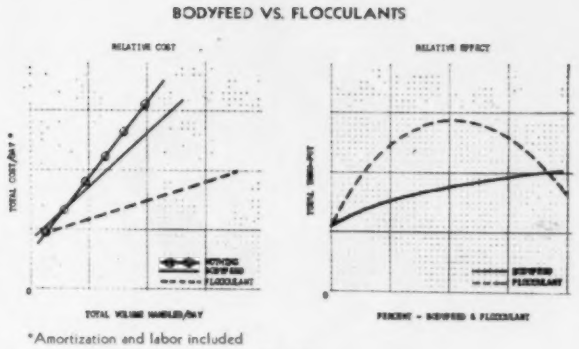


Fig. 12. Effect of the concentration of metal hydrates.



*Amortization and labor included

Fig. 13

Different metal hydrates have different filterability factors. This is illustrated in Fig. 11. Because of this difference in filterability it is necessary to know quite accurately the composition of the finally neutralized wastes; hence the importance of a carefully conducted survey is seen. From the illustration it can be seen that the size of the filter required can vary with the composition of the finally neutralized wastes as regards the various metal hydrates. For example, a relatively small final waste flow that is largely composed of iron will require a larger filter than a relatively larger waste flow that is composed mostly of cadmium.

Effect of concentration of metal hydrates upon filterability of neutralized sludges is illustrated in Fig. 12. The curve is about what one might expect; as concentration increases, flow or filterability decreases. The top range of concentration covered by this illustration is about 10,000 ppm. Studies of concentration have been made on logarithmic recession to about 100 ppm. If one were to hazard a guess on an average figure for the concentration of metal finishing wastes it would probably be 500 ppm.

Pressure filtration of metal finishing wastes in review:

1. Filterability varies inversely with concentration;
2. Each metal hydrate has a different filterability factor;
3. There exists an optimum *p*H range for the pressure filtration of any neutralized waste flow;
4. There is an optimum neutralizer for any waste flow from the standpoint of filterability.

Further research has indicated that substantial increases in filterability can be obtained by the use of various aids to filtration. Fig. 13 illustrates this point. The first body of curves illustrates the relative total cost of pressure filtration using no aids to filtration, using a feed of filter aid, and using a feed of polymeric flocculant. From this body of curves we

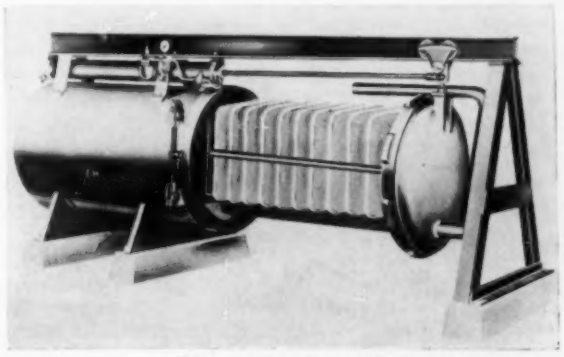


Fig. 14. Filter Type 122.

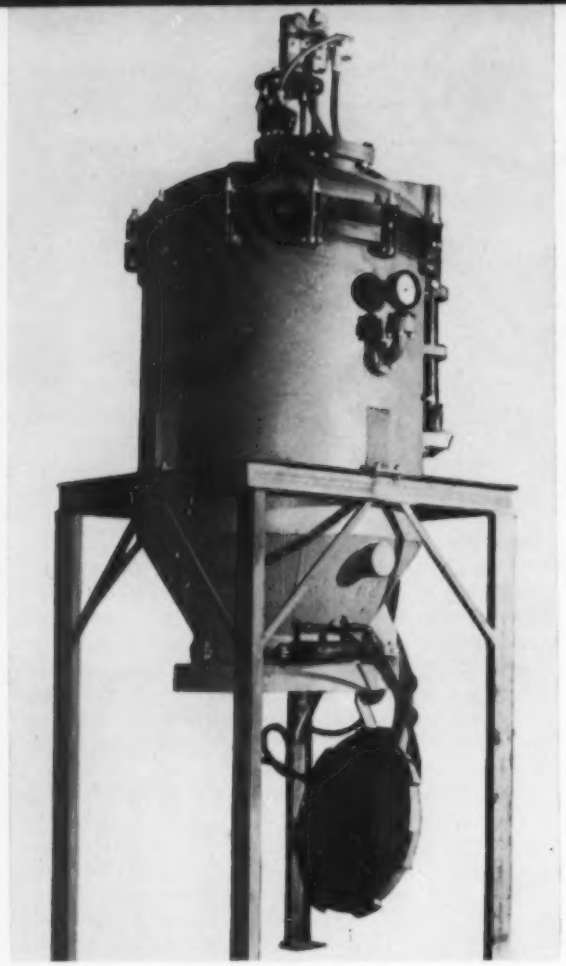


Fig. 15. Filter Type 152.

may conclude in almost every case, that the use of a feed of filter aid or of polymeric flocculant is desirable.

The second body of curves illustrates that excessive use of polymeric flocculant is undesirable, from the standpoints of both reduced filterability and increased operating costs. The effect of the use of polymeric flocculant as an aid to the pressure filtration of neutralized metal finishing wastes is sometimes quite dramatic. In one case, with all other conditions remaining constant, the addition of only 5 ppm of polymeric flocculant increased the pressure filtration cycles from about 4 to 22 hours. Total cost for flocculant per 24 hour day was about $0.90. Research has revealed that the type of polymeric flocculant used also has an effect upon the filterability of the sludge.

In the light of these data it has been necessary to develop equipment designs specifically for the pressure filtration of neutralized metal finishing wastes. Two designs thus far have been developed and perfected, a third is still in the proving stage. Those presently in successful operation on this type of service are the Type 122 and Type 152 designs. Figs. 14 and 15 illustrate their general features.

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DISPOSAL OF PLATING ROOM WASTES*

by ROBERT V. DAY**

THE EFFECTIVE DISPOSAL of the toxic wastes from electroplating, steel hardening, steel cleaning, and other metal finishing processes presents an acute problem to the industry. The wastes cannot be indiscriminately dumped into a stream or river because they could kill all fish life as well as the microscopic life present in the stream. If a sewerage system is available to receive the wastes, care must be taken in dumping the wastes because the toxicity of the wastes reduces the purification efficiency of the various sewage treatment processes. This paper will discuss the effect of plating wastes on a sewage disposal system, and the waste treatment procedures that are available for removing the toxic components of plating room wastes.

EFFECT OF PLATING WASTES ON SEWAGE DISPOSAL SYSTEM

Tarvin[1] reviewed the effects of plating wastes on some Ohio sewage treatment plants and concluded that the wastes has no deleterious effect on the treatment processes in the concentrations received at the plant. It was also reported[1] that the metals nickel, copper, chromium, cadmium and zinc in higher concentrations than found at the treatment plant are toxic to the activated sludge process as determined by laboratory studies. In general, the literature does not report consistent valves on the upper limit of tolerance of the various sewage treatment processes to plating waste constituents.

Excessive concentrations of plating room wastes have reduced the efficiency of a trickling filter and/or an activated sludge type of treatment plant to the point where an acceptable effluent is no longer produced and the sludge digestion process has become poisoned to the point where the digestion has practically stopped.

Many cities and towns have adopted sewer use ordinances that prescribe the maximum concentrations of the various waste constituents of industrial origin that may be discharged to a sewer. Some of the more recent ordinances have set the upper limit at 1–2 mg/l for cyanide, 1–3 mg./l chromium (hexavalent) 1–5 mg/l cadmium; 1–10 mg/l zinc; 1–5 mg/l nickel, and 1–5 mg/l copper; and 1–10 mg/l for chromium (trivalent). The enforcement of such an ordinance will make it necessary to treat most plating room wastes before they may be discharged to a sewer.

In general the various plating wastes constituents are removed in a sewage treatment plant as follows (the percentage removed will vary with the initial concentration):

(1) A portion of chromium is reduced from hexavalent to trivalent by the organic matter in the lateral and trunk sewers before it reaches the treatment plant. The reduction of chromium by organic material will occur throughout the entire treatment plant and the insoluble trivalent chromium is removed by sedimentation.

(2) A portion of the insoluble metal hydroxides are precipitated in the primary tank and are removed by sedimentation and are therefore concentrated in the sludge.

(3) A portion of the cyanide is oxidized by biological treatment processes such as the trickling filter or the activated sludge process. Some of the heavy metals not removed in the primary tank are concentrated in the trickling filter slime and/or the activated sludge and removed in the final sedimentation tank and therefore are concentrated in the sludge.

(4) Post-chlorination to produce a chlorine residual will oxidize the remaining cyanides to cyanates under conditions usually encountered.

(5) The metals that are removed by the sedimentation processes are concentrated in the sludge and thus will accumulate in the sludge digestion tank.

TREATMENT OF PLATING WASTES

The first possibility that should be investigated is the recovery of metals from the waste stream. Ion exchange procedures have been used extensively for the recovery of chromium in many large and small plating shops. It has been demonstrated that it is profitable to recover chromium by this procedure. The ion exchange procedure is a two-step process consisting of first a cation exchange unit for the removal of metals such as iron and aluminum, followed by an anion exchange unit for the removal of chromium. The chromium is recovered when the anion exchange unit is regenerated and it is reported that 3 per cent CrO_3 solution can be recovered.

Weisberg and Quinlan[2] described a plating waste recovery system in which a double effect evaporator is employed for cyanide recovery and ion exchange units are employed for chromium recovery. They report that even with a first cost of $100,000, the substantial savings achieved yielded a satisfactory return on the investment.

The above mentioned recovery systems insure an effluent practically free from all toxic constituents, but it may not be feasible to utilize these procedures at all locations for various reasons; and therefore, other methods of disposal must be sought. The most widely accepted methods of eliminating the toxic cyanide and chromium present in plating wastes are: (1) alkaline chlorination for cyanide disposal, and (2) chromium reduction with sulfur dioxide to the trivalent ion and the precipitation of the latter. These treatment methods are used extensively in many industrial plants throughout the country and many such installations have been reported in the literature.[4, 5, 6]

Alkaline Chlorination of Cyanide

The toxic cyanides are destroyed in plating wastes by oxidation with chlorine and alkali or a hypochlorite at a *p*H of not less than 8.5. Chamberlin and Snyder[7] gave a complete review of the type of cyanide wastes encountered and also a detailed description of the oxidation process of cyanides by chlorine.

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The oxidation of cyanides by chlorine is divided into two separate stages of reaction namely: the first stage is the oxidation of cyanide to cyanate, and the second stage is the oxidation of cyanate to nitrogen and carbon dioxide.

The reactions involved in the first stage of chlorination are as follows:

1. $Cl_2 + NaCN \longrightarrow CNCl + NaCl$

2. $CNCl + 2NaOH \longrightarrow NaCNO + NaCl + H_2O$

Chlorine reacts instantaneously with cyanide at any *p*H level to form cyanogen chlorine as shown by reaction 1. Cyanogen chloride is a volatile, noxious, irritating gas. Reaction 2 is a hydrolysis reaction in which cyanogen chloride is converted to the non-volatile and relatively stable cyanate. The hydrolysis reaction is primarily dependent on *p*H. When the *p*H is less than 8 the hydrolysis is not completed in 2–3 hours, but at a *p*H of 8.5 to 9.0 the reaction is completed in 5 to 10 minutes.

The chlorine requirement for the first stage is theoretically 2.73 parts of chlorine for each part of cyanide, as CN. Due to the presence of other chlorine consuming compounds in the waste, the chlorine requirement usually approaches a 4 to 1 ratio. The alkali requirement is theoretically 1.125 parts of sodium hydroxide for each part of chlorine added, but due to the presence of excess alkali in the waste the requirements are usually less than the computed value.

The reactions involved in the second stage are as follows:

3. $3Cl_2 + 4H_2O + 2NaCNO \longrightarrow 3\,Cl_2 + (NH_4)_2\,CO_3 + Na_2CO_3$

4. $3Cl_2 + 6\,NaOH + (NH_4)_2\,CO_3 + Na_2CO_3 \longrightarrow 2NaHCO_3 + N_2 + 6NaCl + 6H_2O$

The first step of the second stage reaction is the decomposition of cyanate to ammonium carbonate and sodium carbonate in the presence of chlorine. Chlorine does not enter into this reaction chemically, but aids in the decomposition. This first step requires about 1 to 1.5 hours. The second stage is the rapid oxidation of ammonium carbonate to nitrogen gas and carbon dioxide. This reaction takes place at a *p*H of 8.5 to 10.0 and the carbonates are converted to bicarbonates. This second stage reaction requires the presence of free chlorine (hypochlorous acid). It has been shown[7] that hypochlorous does not exist at a *p*H greater than 10.0 and therefore the oxidation of cyanates must take place at a *p*H of less than 10.0.

The chlorine requirement for the second stage reaction is theoretically 4.09 parts of chlorine for each part of cyanate in terms of cyanide, as CN. Due to the presence of other chlorine consuming compounds in the wastes the chlorine requirement is usually greater. This is especially true if ammonia is present in the waste because all the ammonia must be destroyed before free chlorine can be present to oxidize the cyanate. The chlorine requirement for the destruction of ammonia is approximately 10 parts of chlorine for each part of ammonia. Again the alkali requirement is 1.125 parts of sodium hydroxide for each part of chlorine added.

The composite reaction for both the first and second stages is as follows:

5. $3Cl_2 + 10\,NaOH + 2NaCN \longrightarrow 2NaHCO_3 + N_2 + 10\,NaCl + 4H_2O$

The chlorine requirement for the complete destruction of cyanide to nitrogen and carbon dioxide is theoretically 6.82 parts of chlorine for each part of cyanide, as CN. The ratio usually approaches 8 to 1 due to the presence of other chlorine consuming compounds. The alkali requirement is usually less than the theoretically 1.125 parts of sodium hydroxide per part of chlorine added.

The alkali requirements are based on the use of sodium hydroxide, but it is possible to use either hydrated lime or soda ash. The alkali requirement for 1 part of chlorine is about 1.25 parts of hydrated lime or 3.0 parts of soda ash.

Chrome Reduction With Sulfur Dioxide

Hexavalent chromium is removed from plating wastes by treatment with a reducing agent to form the trivalent chromium ion followed by the precipitation of the trivalent chromium with an alkali. The chromium is normally reduced with ferrous iron, sulfur dioxide, or the commercial sodium salts of sulfur dioxide. A comparison of the reduction processes shows a distinct advantage in the use of sulfur dioxide or its derivatives over the use of ferrous iron. The chemical requirements are much greater for the reduction with ferrous iron and about 4 times as much sludge is produced and must be disposed of in precipitation of the trivalent chromium. Chamberlin and Day[8] gave a complete review of the types of chrome wastes that are usually encountered and also a detailed description of the reduction of chrome with sulfur dioxide.

The reactions involved in the reduction of chrome to the trivalent ion with sulfur dioxide and two of the common sodium salts of sulfur dioxide are as follows:

6. Sulfur Dioxide
   $3SO_2 + 2H_2CrO_4 \longrightarrow Cr_2\,(SO_4)_3 + 2H_2O$

7. Sodium Bisulfite
   $3NaHSO_3 + 1.5\,H_2SO_4 + 2H_2CrO_4 \longrightarrow Cr_2\,(SO_4)_3 + 1.5\,Na_2SO_4 + 5H_2O$

8. Sodium Sulfite
   $3Na_2SO_3 + 3H_2SO_4 + 2H_2CrO_4 \longrightarrow Cr_2\,(SO_4)_3 + 3Na_2SO_4 + 5H_2O$

The rate of the reduction reaction is dependent on the *p*H at which the reduction takes place. The reaction is practically instantaneous in the *p*H range of 1.0 to 2.0 and requires about 30 minutes for completion at a *p*H of 3.0. The rate of reaction decreases with an increasing *p*H to a point where the reaction is not complete in 3 hours at a *p*H of 5.0.

The above reactions show that theoretically 1.85 parts of sulfur dioxide are required for each part of chrome, as Cr; 3.0 parts of sodium bisulfite per part of chrome; and 3.6 parts of sodium sulfite for each part of chrome. In actual practice these ratios are increased quite appreciably due to the loss of the reducing agent to the dissolved oxygen present in the waste. Approximately 4.0 parts of sulfur dioxide are required for each part of dissolved oxygen and with a known dissolved oxygen content of approximately 9.0 mg/l at room temperature, the loss can represent a large portion of the sulfur dioxide used. It has been estimated[8] that the sulfur dioxide requirement is about 1.9 parts per part of chrome when a wastes is treated that has a chrome concentration of 500 mg/l but increases to about 9.0 parts per part of chrome when the chrome concentration is only 5.0 mg/l.

The acid requirement for the reduction will vary with the initial *p*H of the waste and the reducing agent employed. When sulfur dioxide is used as the reducing agent, the acid requirement is the acid required to depress the *p*H of the waste to the desired *p*H level. However, if the sodium salts of sulfur dioxide are employed additional acid is required to

maintain the *p*H at the desired level. This additional acid requirement will vary with the *p*H level employed in the reduction and can be as high as 5.6 parts of sulfuric acid for each part of the chrome if sodium sulfite is employed and the reaction *p*H is 1.0.

Trivalent chrome is precipitated by the addition of alkalies such as caustic soda, lime, or soda ash. The precipitate commonly called chromic hydroxide is amphoteric; that is, it is soluble in certain concentrations of both acidity and alkalinity. It was found[8] that the point of minimum solubility was at a *p*H of 8.5 and that appreciable quantities of chrome were soluble at and below a *p*H of 7.0 and also at and above a *p*H of 10.0. The relatively narrow range points up the needs for very close control of the *p*H during the precipitation process. Approximately a 1.5 to 2.0 hour detention time is required for the removal of the precipitate.

BASIC TYPES OF WASTE TREATMENT PLANTS

Batch Treatment Plant

The batch type of treatment plant is the conventional fill and draw type of plant that can be adopted to treat either cyanide and chrome wastes.

In a batch type treatment plant a minimum of 2 holding tanks is provided, and each tank should have a minimum holding capacity of at least four hours waste flow. The scheme of operation is that one tank is treated and disposed of while the other tank is filling. Treatment of the wastes is accomplished by circulating the wastes through the tank by the use of a pump and the addition of the appropriate chemicals to either the pump suction or discharge. Treatment is continued until the desired results are obtained. This is the basic batch type treatment plant and there are many other variations possible to fit each individual waste condition.

Flow-Through Treatment Plant

The flow-through type of treatment plant is the conventional continuous flow type of plant and can also be adopted to treat either cyanide or chrome wastes.

The basic flow-through treatment plant consists of an equalization tank, reaction tank, and final settling tank. Many other variations are possible to accomplish the desired results and the layout can be varied to meet existing local conditions. In this scheme of operation it is necessary that a waste equalization tank be employed in order that the variations in cyanide or chrome concentration be minimized. It is recommended that this equalization tank have at least 1 to 4 hours holding capacity, and that some type of mixing device either fixed or mechanical be employed.

The chemicals are added to the waste stream just before it enters the reaction tank with special care taken to insure that complete mixing is obtained. The capacity of the reaction tank varies with the type of waste and the desired results as follows:

Chrome Waste	5–10 minutes
Cyanide Waste	
Oxidized to cyanates	10–15 minutes
Complete oxidation to CO_2 and N_2	2 hours

The final settling tank should provide a minimum of 2 hours detention in order to insure maximum removal of the precipitated metal hydroxides. In the case of chrome waste treatment, provisions must be made for the addition of an alkali before the final settling tank.

SUMMARY

1. The effect of plating room wastes on the sewage disposal system and how the various wastes constituents are removed in the treatment plant are discussed.

2. The basic chemical reactions involved in the oxidation of cyanides wastes with chlorine and the reduction of chrome wastes with sulfur dioxide are reviewed.

3. The basic plating room waste treatment schemes are presented and discussed briefly.

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Robert V. Day received his BS degree in sanitary engineering in 1948 from Rutgers University and an MS in 1950 from the same University. While a graduate student, he conducted basic research at Rutgers on principles of sewage disinfection with chlorine. In 1950, he joined Lee T. Purcell, consulting engineer of Paterson, N. J. in the capacity of project engineer. From 1951 to 1956, Mr. Day was with Wallace and Tiernan, developing methods and procedures for the disinfection of sewage and industrial wastes. He has been with Clyde E. Williams and Associates, Inc., since 1957 as project engineer in charge of operation of water supply systems, and is concerned with the planning of sewage and water treatment plants. He is a registered professional engineer, and a member of the Federation of Sewage and Industrial Wastes Association and American Water Works Association.

SOME ENGINEERING ASPECTS OF A GOOD FILTRATION SYSTEM

by CHESTER G. BORLET*

Certain engineering aspects of a plating solution filtration system are covered. Piping arrangement and filter location, as well as solution discharge velocity, are of prime importance in the elimination of rough electrodeposits. Engineering a filtration system as related should insure good filtration and deposits will be practically free of roughness.

As PART OF A SYMPOSIUM at the Thirty-eighth AES Annual Convention in Buffalo, New York in 1951, a paper[1] was presented entitled "Electroplating Zinc Base Die Castings".

A recent critical review of this paper revealed the need of detailed clarification of many of the phases covered. The subject was broken down into what was termed important factors affecting electrodeposition. These factors at best could only be treated in a general way. To have done justice to the subject would have required a complete presentation on each point which could easily have resulted in a book on the subject of electroplating of zinc base die castings.

As an example, the principal factors listed were as follows:

INTERNAL	EXTERNAL
1. Composition	1. Rinsing
2. *p*H	2. Agitation
3. Temperature	3. Current Source
4. Current Density	4. Plating Racks
5. Impurities	5. Filtration

All of these are, of course, very important to the successful operation of any electroplating system in production work.

There is one external factor listed that may be classified as a physical aid of paramount importance, namely FILTRATION. That paper devoted three general paragraphs to this subject which is one of the more essential auxiliary operations used in any electroplating system. The requirements of a good filtration system are so exacting today that careful consideration should be given to all the engineering aspects.

There is one fundamental reason for filtering plating solutions. Plating solutions are filtered intermittently or continuously to remove suspended matter of a physical nature. In addition to solids as we visualize them, filtration removes many soluble materials, organic in nature, by absorption techniques.

Not only does filtration remove solids, but it affects to some extent a degree of solution agitation. It is quite difficult, and also impractical, to engineer a filtration system so as to obtain maximum agitation. In fact, a major mathematical problem is encountered in determining the rate of solution turnover necessary to obtain the degree of agitation required. There are other methods, easily engineered, which are far more satisfactory.

The plating industry uses two methods to clarify plating solutions—BATCH and CONTINUOUS FILTRATION.

Batch filtration is generally used following a chemical solution treatment or an accidental spillage of physical material into the plating solution. Batch filtration is carried out by transferring the contaminated solution to a storage tank. After treatment the solution is filtered back into the clean plating tank.

Continuous filtration is usually used to remove the small amount of air-borne dirt that falls into the plating solution, as well as other solid particles that may be introduced into the bath. The other solid particles may arise from a number of sources such as buffing compounds from poorly cleaned work, torn anode bags, faulty rack coating, metal particles from plating rack bleeders and fallen parts.

Filters designed for use by the plating industry may be either for batch or continuous filtration. Generally the better types of filters suited for the clarification of electroplating solutions are (1) Horizontal Plate Pressure, (2) Vertical Plate Pressure, (3) Vertical Plate Vacuum, (4) Horizontal Disc Pressure, (5) Plate and Frame, (6) Porous or Fabric Tube. These filters have been grouped as a filtration engineer would classify them for specific filtration requirements.

Fully cognizant of filtration requirements and types of filters available, the engineer should consider exactly how to install the most suitable and efficient filtration system. It can safely be said that even with carefully selected filters of the best quality, only a mediocre job will be done if the installation is not properly engineered.

A filter or filters correctly prepared to give a good clear solution may do little in the way of keeping the solution free of suspended material, if not properly piped to the plating tank. In all cases the filter intake should be from the bottom of the plating tank, either from a valved sump or from a hose directed over the wall of the plating tank to its bottom.

The discharge should be from the top of the solution through a header pipe. The base material for the header pipe should

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TABLE I

VELOCITY REDUCTION (TYPICAL EXAMPLE)

Filler flow rate	= 8000 gal/hr
Discharge pipe 2½ in. diam	= 4.90 sq in. cross section
Header pipe 3 in. diam by 10 ft long	= 7.068 sq in. cross section
Holes in header pipe 10–1¼ in. diam	= 12.35 sq in. cross section
Discharge pipe to header	= 1630 gal/sq in./hr
Header pipe to holes	= 1130 gal/sq in./hr
Holes to solution	= 647.5 gal/sq in./hr
Velocity reduction ratio	= 2.5 to 1

be compatible with the plating solution in question, that is, acid resistant materials for acid solutions and the alkali resistant materials for alkaline solutions. The header pipe should have an internal diameter slightly larger than the discharge line from the filter. The internal diameter, length, diameter of holes and number of holes in the header pipe should be calculated so that the velocity of the effluent will be in ratio of at least 2.5 to 1 (Table I). The header is located so that the filtrate is discharged at a slight angle just below the solution level in the tank. The function of the discharge header is to reduce the velocity of the solution being filtered to a practical minimum value. Reducing the velocity of the filtrate and distributing it over a large area insures a uniform downward movement of the solution throughout the plating tank. Localized turbulence which seems to hold particles in suspension is eliminated and those particles will now move freely towards the bottom of the tank and be removed through the filter intake.

When a single filter unit of the correct capacity is used for filtration, piping arrangement is not a particular problem as long as the header pipe produces the calculated reduction of velocity. However, if more than one filter is needed to develop the required solution turnover, they should be piped independently so that each filter has a separate intake and discharge line. The discharge line from the filter may, if room permits, be piped to more than one header, as long as the headers serve only one filter. (Fig. 1.) It may work out that the size of the plating tank is such that the length of the header pipe will produce a reduction of velocity greater than shown in Table I. This would be very good as the value in the table was obtained by experience which dictated the value should not be below that shown.

Two or more filters should not be connected to a common discharge even though a system of headers is used. There is a possibility that the rate of flow and/or the pressure of the discharge of one filter will be reduced due to a restriction within the filter chamber. One of the other filters will then exert a pressure equal to or greater than the effluent pressure of the restricted filter. The precoat material and other solid particles will dislodge from the filter cloths of the aforementioned filter. This filter will then pass more solution and as the discharge pressure builds up particles will pass through the filter cloths until they are completely coated. These results have been observed in actual practice.

CONCLUSION

From the facts developed here, it may be deduced that good filtration is dependent on careful engineering of the piping arrangement.

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Chester G. Borlet was born in Salem, New Hampshire, received his BS degree from Kent State University, and did graduate work at Western Reserve and Detroit Universities. He has held research engineering, sales and service, and supervisory positions with Harshaw Chemical Co., United Chromium, McGean Chemical Co., and is presently technical director of Grand Rapids Brass Co. He has been an American Electroplaters' Society member for 20 years and is now national second vice president.

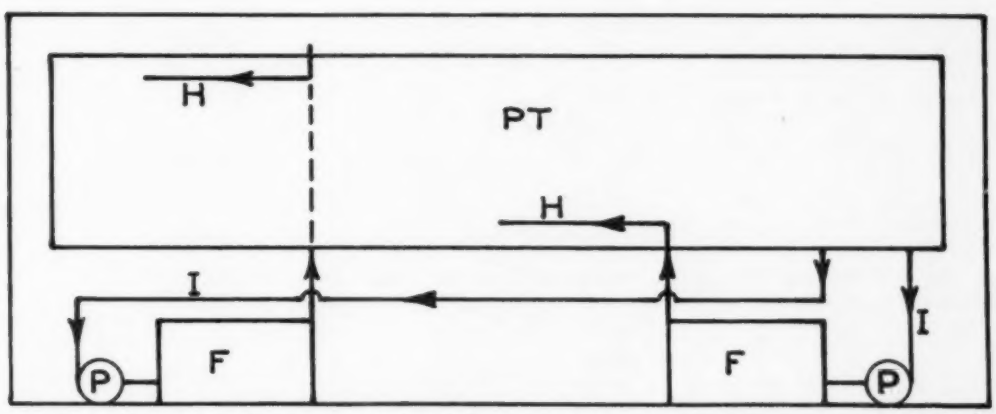

Fig. 1 Typical piping diagram. Legend: H = Header, I = Intake, F = Filter, PT = Plating Tank, P = Pump.

The NEW STUTZ Plating Barrels

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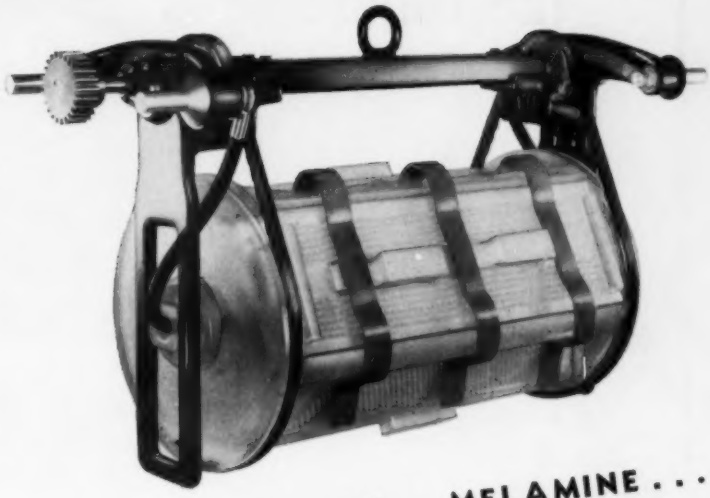

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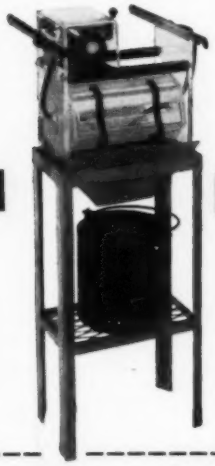

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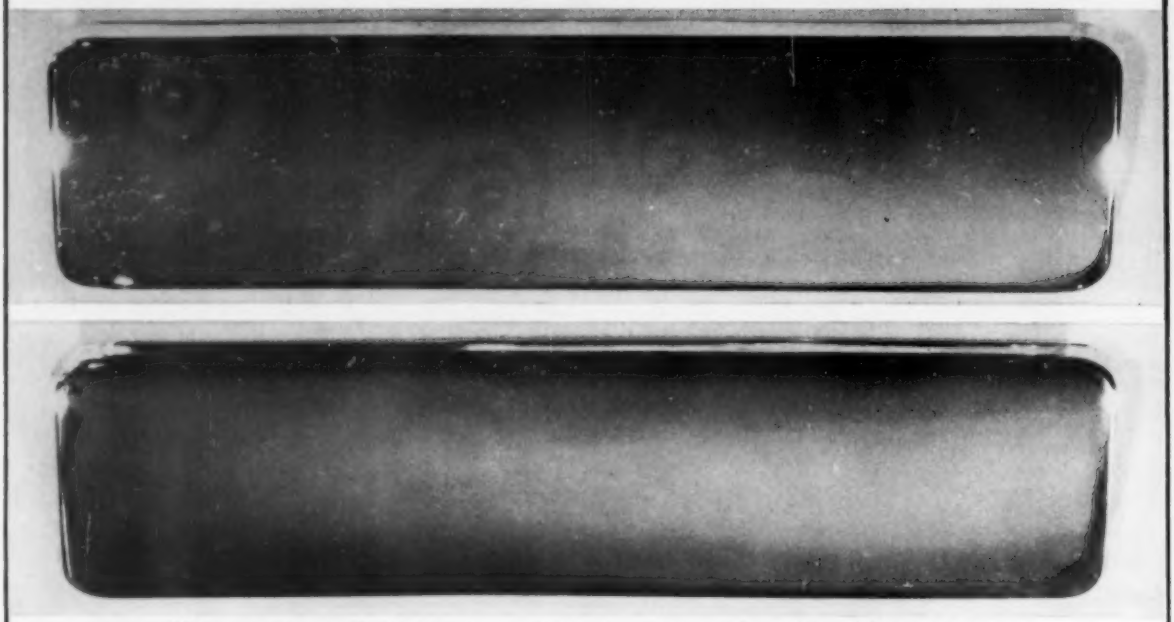

These unretouched photos show plated zinc die-cast bars. *Top Photo:* Plating defects are visible on a bar precleaned with a conventional soak cleaner. *Bottom Photo:* Note the bright, lustrous, defect-free plate of the bar precleaned with Kelite SUPERSOLV as the soak cleaner.

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GOLDEN JUBILEE CONVENTION AND EXPOSITION EARN INTERNATIONAL ATTENTION

DRAMATIC and fitting climax of its year-long FIFTIETH ANNIVERSARY observance, American Electroplaters' Society, Inc. (AES) conducted its unique Golden Jubilee Convention and Industrial Finishing Exposition, including its concurrent Fifth International Conference on Electrodeposition and Metal Finishing, in Detroit, Michigan, June 15-19, 1959, with the dynamic Detroit Branch, its largest chartered affiliate, as Host Branch.

With eight Detroit hotels bulging with AES members and their families, and with many visitors and guests present from near and distant places including many foreign countries, the Society's GOLDEN JUBILEE climax events earned broad international attention in scientific and technical circles and in the press.

Greeted by the President of the United States and by government leaders and statesmen of other countries, the AES was welcomed to Michigan and Detroit by Governor G. Mennen Williams and by Mayor Louis C. Miriani. The entire week of the AES's Convention, Exposition and International Conference, in fact, was proclaimed by Detroit's Mayor as "AES GOLDEN JUBILEE WEEK IN DETROIT".

CONVENTION REWARDS FOUR-YEAR PLANNING

Result of four years of effective planning and effort by a large and well-departmentized Committee of the AES's seasoned Detroit Branch, headed by General Convention Chairman Wright W. Wilson in coordination with AES National Officers and National Headquarters, the Golden Jubilee Convention marshaled the most complete and versatile complement of Convention educational, fellowship and relaxational fare in the Society's eventful half-century history. Anniversary atmosphere and spirit prevailed, and there was appropriately measured GOLDEN JUBILEE pageantry and circumstance. It also featured a large-scale, memorable Ladies Program—abundant plant tours—many gifts and prizes.

WORLD EXPERTS ADDRESS ASSEMBLIES

As the Fifth International Conference on Electrodeposition and Metal Finishing, the Golden Jubilee Convention's educational sessions numbered eleven. Experts from nine countries, including the United States, England, Canada, Australia, France, Germany, Holland, India and Italy, presented 43 technical and scientific papers enriching knowledge in electroplating, metal finishing and allied arts. Three sessions alone covered organic finishing. High spot of the sessions was the first "William Blum Lecture" that was delivered as the Conference's leadoff attraction by the eminent Dr. William Blum himself, first winner of the AES Scientific Achievement Award, the Society's highest scientific honor.

Under the supervision of the AES's Editorial Board, the International Conference was planned for the AES by Past President Walter L. Pinner, Chairman of the International Council on Electrodeposition and Metal Finishing. His Committee included Messrs. T. P. Hoar, Simon Wernick, A. W. Wallbank, R. A. F. Hammond and George Gardam of England and Myron B. Diggin, Dr. Walter R. Meyer and Dr. Richard B. Saltonstall of the United States.

VAST EXPOSITION ENRICHES KNOWLEDGE

AES's Industrial Finishing Exposition, largest of its kind in the Society's history, featured some 36,000 square feet of exhibition space, and this area was employed by nearly 150 prominent industrial companies to display educationally their latest equipment and processes vital to electroplaters and metal finishers. AES's memorable Exposition was headed by Exposition Chairman Howard J. McAleer, President of the Formax Manufacturing Company of Detroit, assisted by Vice Chairman Manuel Ben of the General Motors Corporation. Held at the Artillery Armory in Oak Park, Michigan, during the four-day

AES HEAD LAUNCHES GOLDEN JUBILEE EXPOSITION
National President Head cuts ribbon launching the AES's Fifth Industrial Finishing Exposition, Tuesday, June 16. Left to right Past President W. M. Phillips; International Conference Chairman W. L. Pinner; Mr. Head; Exposition Vice Chairman Manuel Ben; National Executive Secretary John P. Nichols and Exposition Chairman Howard J. McAleer.

(1,2,3) The busy registration foyer of the Hotel Statler-Hilton on Sunday afternoon. (4,5) Golden Jubilee Get-Together Party. (6,7) Golden Jubilee Open House at the Sheraton-Cadillac, sponsored by the Metal Finishing Suppliers' Association. (8,9) Buses provided transporation between the Convention hotel and the Exposition at the Artillery Armory.

period from June 16 through June 19 with shuttle buses transporting large audience from Detroit's Statler-Hilton Hotel, Convention Headquarters, the Anniversary Exposition was officially launched at an opening ceremony, Tuesday, June 16. The ribbon-cutting symbolizing the Exposition's official debut was performed by National President Head in the presence of an impressive circle of National officers, Exposition leaders and distinguished guests.

AES HONORS ACHIEVEMENT

Dr. A. Kenneth Graham was announced at the Grand Opening Session of the Golden Jubilee Convention as the second annual winner of the AES Scientific Achievement Award, the Society's summit scientific honor. And at the First Business Session of the Supreme Society, AES's apex governing council, winning authors of outstanding AES published technical and scientific papers were presented with their earned Awards.

One of the significant moments of the Convention was the announcement at the Farewell Banquet of the Supreme Society's inauguration of an annual Charles Henry Proctor Memorial Leadership Award donated by Mr. and Mrs. William O. Preston, son-in-law and daughter respectively of Charles H. Proctor, Founder-President of the National Electro-Platers Association of the United States and Canada which was transformed into today's AES in 1913. The new Award will be presented for the first time at the Final Banquet of the AES's Los Angeles Convention in July 1960.

WYSONG ASCENDS TO AES HELM

AES First Vice President Ralph D. Wysong of South Bend, Indiana, was elected National President of the Society at the Second Business Session of the Supreme Society and was installed as AES's 45th President midst honors. He succeeded Herberth E. Head of Detroit, President during AES's FIFTIETH ANNIVERSARY year, who continues on the Executive Board as Immediate Past President.

To the Third Vice Presidency, the Supreme Society elected Manuel Ben of Detroit, Michigan, and to the other vice presidencies, it up-graded Dr. W. Andrew Wesley and Chester G. Borlet respectively. It also elevated Past Presidents Arthur W. Logozzo and G. P. Swift to coveted Honorary Membership of the Society.

CONVENTION'S FUNCTIONAL LEADERSHIP

Aside from the already named leaders of the AES's long-to-be-remembered Golden Jubilee Convention, Exposition and International Conference, General Convention Chairman Wilson's functional Sub-Chairmen included John F. Siefen (Finance); Mrs. Alice Pillsbury (Ladies Program); William P. Katke Jr. (Hotel Liaison); Donald M. Bigge (Banquet); Donald C. Austin (Registration); Robert C. Trees (Publicity); Robert H. Dudley (Outing); A. J. Turner (Entertainment); James E. Fritts (Plant Visits); H. E. Nice and Wilson McCormick (Hotel Rooms) and Charles L. Southwick (Transportation).

The day-to-day log of this unique three-headed climax of AES FIFTIETH ANNIVERSARY follows.

SUNDAY, JUNE 14

The Executive Board met in full-day's meeting and subdued a heavy and challenging Agenda. That same afternoon, the Credentials Committee under Past President Cleveland F. Nixon completed its business and its final report. The Honorary Membership Awards Committee also met in executive session that afternoon and accomplished mission channeled to it by the Executive Board.

Convention registration also made an auspicious start that Sunday. And that evening in the Statler-Hilton Hotel's spacious Grand Ballroom, a vast AES audience attended and enjoyed the Golden Jubilee Convention's opening social event, namely the Golden Jubilee Get-Together Party.

GRAND OPENING SESSION OF THE GOLDEN JUBILEE CONVENTION

(1) Dignitaries on the dais join in singing the National Anthems. (2) Packed Ballroom at the opening ceremonies. (3) General Convention Chairman Wright W. Wilson, at the dais, calls the Convention to order. (4) Dr. A. Kenneth Graham, standing, announced as the winner of the 1959 AES Scientific Achievement Award. (5) Mayor Louis C. Miriani conveys Detroit's welcome. (6) National President Herberth E. Head officially opens the Convention. Seated, Michigan's Lieutenant Governor John B. Swainson. (7) Irving A. Duffy, vice president of Ford Motor Co., delivering the principal address.

MONDAY, JUNE 15

The Statler-Hilton's Grand Ballroom was well-dressed for the Golden Jubilee Convention's Grand Opening Session. A three-tier dais fronted the assembly hall, and dais backdrop was the AES's huge new ceremonial banner. The big room was filled to capacity by ten o'clock when dais occupants filed in from the adjoining Ivory Room. Among them were all of AES's National Officers, the President of the Detroit Branch and the heads of the Convention, Exposition, and International Conference. Also among them were the leaders of the foreign delegations. Among them too were some twenty AES Past Presidents. And among them were Lieutenant Governor John B. Swainson and Mayor Louis C. Miriani.

AES GREETED BY PRESIDENT EISENHOWER

Following the rendering of the National Anthems, and the delivery of the invocation by the Reverend Canon Irwin C. Johnson of Detroit's St. John's Episcopal Church, the AES was formally welcomed to Detroit by Mayor Miriani. Presented next by General Convention Chairman Wilson who served as Master of Ceremonies, National President Herberth E. Head responded in behalf of the Society, then read to the assembly, the personal greetings of President Dwight D. Eisenhower. The assembly next heard the Memorial Roll read by National Executive Secretary John P. Nichols, then stood in reverend moment of silence as a tribute to the memory not only of the deceased who founded and developed AES through the five decades of its lifetime but also of those who demised during 1958-1959, AES's FIFTIETH ANNIVERSARY year.

Lieutenant Governor Swainson next read a personal telegram from Governor G. Mennen Williams, then extended Michigan's greetings to the Society. And the assembly also heard brief welcoming talks by Chairman Wilson, by Detroit Branch President Donald M. Bigge and by Ladies Chairman Alice Pillsbury. The principal address was delivered by Irving A. Duffy, Vice President of the Ford Motor Company.

Dr. A. Kenneth Graham was announced as second winner of the annual AES Scientific Achievement Award, the Society's highest scientific honor. The announcement was made by Chairman Abner Brenner of the Award's Selection Committee.

GAVEL PRESENTED TO SUPREME SOCIETY

The Grand Opening Session terminated with the traditional ceremony during which Convention Chairman Wilson turned the Convention over to National President Head. An innovation was the presentation by Chairman Wilson, in behalf of the Detroit Branch, of a gold-plated gavel symbolic of t he GOLDEN JUBILEE to the Nationa

FIRST BUSINESS SESSION OF THE SUPREME SOCIETY

Dr. Edward B. Saubestre receives Paper Award presentation from Frank Beuckman, chairman of the Paper Awards Committee. (2) Delegates conducting Society business. (3) Winners of the 1959 Paper Awards, left to right, Dr. Edward B. Saubestre, Enthone, Inc.; Dr. Abraham M. Max, Radio Corp. of America; Donald R. Millage and Wilbur E. Hague, Udylite Research Corp.

FIFTH INTERNATIONAL CONFERENCE HAS AUSPICIOUS BEGINNING

(1) Walter L. Pinner, chairman of the International Council and Educational Program, opens the Fifth International Conference on Electrodeposition and Metal Finishing. (2) Vast audience at the first session of the Conference. (3) Dr. T. P. Hoar, president, Institute of Metal Finishing, London. (4) Dr. William Blum, first winner of the AES Scientific Achievement Award, at the conclusion of his delivery of the first "William Blum Lecture," receives honorarium and plaque from President Head. (5) Members of the International Council for Electrodeposition, (l to r) R. A. F. Hammond, Dr. T. P. Hoar, Myron B. Diggin, Dr. Simon Wernick, Walter L. Pinner, A. W. Wallbank, Dr. Richard B. Saltonstall, A. A. B. Harvey and Dr. Walter R. Meyer.

Society for use not only throughout the instant Golden Jubilee Convention but also at all subsequent Convention Opening Sessions and Annual Meetings of the Supreme Society. In accepting it for AES, President Head stated that it would henceforth serve the Supreme Society substantially as the gold-plated gavel received from the Dixie Region in February 1959 will serve the Executive Board.

GOVERNING COUNCIL'S BUSINESS SESSION

The First Business Session of the Supreme Society was held immediately after the Grand Opening Session in the same assembly room with National President Head himself presiding.

That Supreme Society meeting approved the report of the Credentials Committee presented by Chairman Cleveland F. Nixon. Besides receiving the reports of the six National Officers and of the Society's standing and special committees; besides hearing of the temporary chartering of two new Branches, namely Phoenix (Arizona) and Denver (Colorado); besides preliminarily considering the 1958-1959 financial statement and the proposed 1959-1960 AES/PLATING MAGAZINE operating budget and besides considering proposed Constitutional and Bylaw amendments, the Society's governing council heard the report of Chairman Frank O. Beuckman of the AES's Paper Award Selection Committee. Consequently the following Awards were next made to the following:

THE CARL HEUSSNER GOLD MEDAL AWARD To Dr. E. B. Saubestre, Enthone, Inc., for the paper, "The Chemistry of Watts Nickel Plating Solutions" that appeared in the September 1958 issue of PLATING MAGAZINE.

THE AES SILVER MEDAL to Dr. Abraham M. Max, Radio Corporation of America for the paper titled, "Factors Which Influence the Structure of Electrodeposits" that appeared in TECHNICAL PROCEEDINGS (1958 Edition).

THE AES BRONZE MEDAL To Dr. Ernst Raub, Forschungsinstitut Und Probleramt Fur Edelmetalle, for the paper, "Research on Microthrowing Power and Leveling of Plating Baths" that appeared in the May 1958 issue of PLATING MAGAZINE.

THE GEORGE B. HOGABOOM AWARD To Dr. E. B. Saubestre, Enthone, Inc., for the paper, "The Chemistry of Watts Nickel Plating Solutions" that appeared in the September 1958 issue of PLATING MAGAZINE.

THE CHROMIUM PLATING AWARD To Donald R. Millage and Wilbur E. Hague, The Udylite Research Corporation, for the paper, "Pitting in Thick Chromium Deposits", that appeared in TECHNICAL PROCEEDINGS (1958 Edition).

The Paper Awards Committee made no 1958-1959 selections for the Precious Metals Plating Award, The Robert S. Leather Award and for the John J. Hanney Memorial Award due to less than the required number of papers available for selection.

AES STANDING COMMITTEES MANNED

In behalf of the Executive Board, National Executive Secretary Nichols next announced appointment by the Board of the following to these AES standing committees for respective three year terms effective June 15, 1959:

EDITORIAL BOARD: Dr. Henry L. Kellner, Lea Manufacturing Company; Dr. Joseph V. Petrocelli, International Nickel Co. and Dr. Edward B. Sau-

AES's BUSY BOARDS AND COMMITTEES IN ACTION IN DETROIT

(1) Research Committee breakfast. (2) Research Committee meeting. (3) Branch Secretaries luncheon. (4) Educational Committee in session. (5) Branch Librarians and Educational Committee luncheon. (6) Editorial Board. (7) Publications Committee. (8) Midwest Regional Council. (9) Public Relations Committee. (10) Membership Committee Breakfast. (11) Honorary Membership Awards Committee. (12) Executive Board meets with Credentials Committee. (13) Order of Past Presidents meeting. (14) National Executive Secretary Nichols and Law Committee Chairman Manson Glover burn the midnight oil. (15) Order of Past Presidents dinner.

bestre, Enthone, Inc. Also Earl W. Arnold, L. H. Butcher Co., Los Angeles (one year).

EDUCATIONAL COMMITTEE: (To be Announced)

HONORARY MEMBERSHIP AWARDS COMMITTEE: Dr. Samuel Heiman, Philadelphia Rust Proof Co. and Andrew P. Julius, Hager Hinge Co.

MEMBERSHIP COMMITTEE: John J. Bunsic, General Electric Co; George W. Taylor, Production Plating Company and Myron E. Browning, Convair Company.

PUBLICATIONS COMMITTEE: W. W. Sellers, Jr., International Nickel Co.; Paul A. Waalkes, Hanson-Van Winkle-Munning Co., and Francis T. Eddy, Bayside Plating Company.

PUBLIC RELATIONS COMMITTEE: Robert M. Norton, Hanson-Van Winkle-Munning Co; Eugene Roth, Roth Plating Corp; Kenneth C. Reifsteck, General Electric Co.

RESEARCH COMMITTEE: Richard A. Fellows, The Udylite Corp.; Edward J. Kubis, Wyandotte Chemicals Corporation; Dr. Harold J. Wiesner, Bendix Aircraft Co.

SCIENTIFIC ACHIEVEMENT AWARD COMMITTEE: Dr. Henry B. Linford, Columbia University and Dr. Harold J. Wiesner, Bendix Aircraft Co.

BRITISH DELEGATION AT GOLDEN JUBILEE

Part of the British Delegation that graced the AES's GOLDEN JUBILEE Convention with Dr. T. P. Hoar, President of England's Institute of Metal Finishing, in direct center.

BRANCH SECRETARIES IN ANNUAL MEETING

Three luncheons occupied this Monday's noon period, namely 1) the Ladies' repast at the Detroit Yacht Club, 2) the Speakers Luncheon and 3) the traditional Branch Secretaries Luncheon held in the English Room of the Statler-Hilton with National Executive Secretary Nichols presiding. Attended by a record-number of Branch Secretaries, many Branch subjects of mutual interest were discussed with mutual benefit.

INTERNATIONAL CONFERENCE'S DEBUT

In the appropriately dressed Grand Ballroom of the Statler-Hilton Hotel before a capacity audience, the Fifth International Conference on Electrodeposition and Metal Finishing was launched by International Council Chairman Walter L. Pinner at 2:00 p.m. Introduced was Dr. T. P. Hoar, President of the Institute of Metal Finishing of England, who then presided for the balance of that impressive session.

The AES's long anticipated first "William Blum Lecture" opened the Conference and was delivered by the distinguished Washington scientist, Dr. William Blum himself, first winner of AES Scientific Achievement Award. Discussing "Education and the Electroplating Industry", his paper earned wide favorable appraisal. At its conclusion, he was presented with the first scroll of the AES Scientific Achievement Award plus a $500 attendant honorarium by National President Head in behalf of the American Electroplaters' Society.

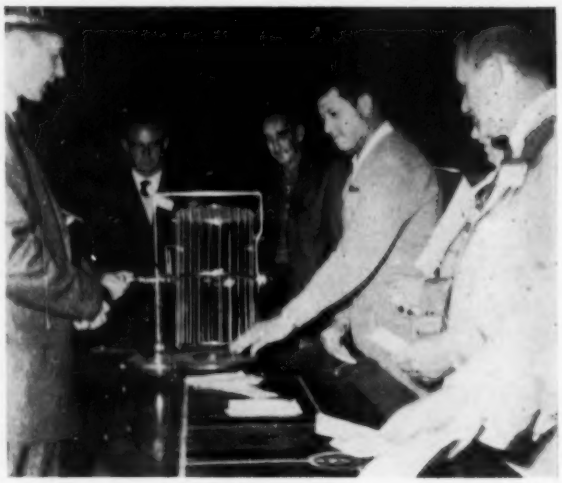
THOMAS A. TRUMBOUR PORTRAIT UNVEILED

A handsome portrait of the late Thomas A. Trumbour, a founding father of AES and of the MFSA, was unveiled by A. P. Munning, Secretary of MFSA, at the Exposition, June 16. Left to right, AES National President H. E. Head; First Vice President R. D. Wysong; John Trumbour, son of the deceased; Mr. Munning; Palmer H. Langdon, publisher of "Metal Finishing" and Mrs. Joan Wiarda, daughter of the departed and President of "Metal Finishing."

EDITORIAL BOARD IN RESULTFUL MEETING

While the large audience heard other important international Conference papers in the Grand Ballroom, the Editorial Board was meantime in session in Parlor E with Chairman John P. Nichols presiding.

The Editorial Board complimented its retiring members, namely Dr. Abner Brenner, William M. Tucker and S. L. Doughty for worthy service during their respective three-year terms, then welcomed its new members. It extended Board commendation to Walter L. Pinner, Host Branch Educational Chairman, for high-grade performance in the development of the International Conference. It then finalized work remaining on that Conference, then commenced its arduous work on the 1960 Los Angeles Convention's educational sessions, with Earl W. Arnold, the Los Angeles Branch's Host Branch Educational Sessions Chairman, present and active in the discussion and planning.



Fun at the Millionaires' Party

PAST PRESIDENTS ELECT HEIMAN

That same afternoon, the Order of Past Presidents conducted its annual business meeting, then held its annual dinner meeting. During the former, Past President Samuel Heiman was elected President of the Order, and Past President Francis T. Eddy was named Secretary-Treasurer. Dr. Heiman succeeds Past President Samuel S. Johnston.

That eventful Monday concluded with a gala Open House sponsored for the AES by the Metal Finishing Suppliers' Association that earlier that day had elected as its 1959-1960 President, Raymond F. Ledford, President of the Chemray Corporation succeeding Earle W. Couch, President of the Lea Manufacturing Company.

TUESDAY, JUNE 16

Members of the Research Committee, District Supervisors, Past Research Chairmen, other key Research Program personnel, together with AES National Officers, attended the traditional Research Program Breakfast held in the Statler-Hilton's Parlor F, Tuesday morning, June 16. Elsewhere, the day's International Conference speakers were guests of the Convention at breakfast.

And while Session B of the International Conference was being held in the Grand Ballroom later that forenoon, Session C was being conducted in the Michigan Room. Both sessions were being carried on before capacity audiences. Meanwhile, the Research Committee was in executive session in Parlor F with Chairman Russel E.

AES FIFTIETH ANNIVERSARY LOUNGE AT AES'S INDUSTRIAL EXPOSITION

(1) View from distance of the front of the exhibit. (2) Revolving cylinder displaying PLATING MAGAZINE covers. (3) Close view of the front of the exhibit. (4) Side view of the exhibit. (5) Panel lists AES Sustaining Members. (6) "Kaleidoscope of AES's First Half-Century." (7) Panel nearest camera blazoning "Golden Circle of Plating Magazine Advertisers." (8) "The Odyssey of a PLATING MAGAZINE Issue." (9) Manuel Ben, Exposition co-chairman, and Wright W. Wilson, convention general chairman, point to important dates in AES history. (10) The Research Committee and its activities. (11) Another view of the PLATING exhibit.

Harr presiding. And the Educational Committee was convened in Parlor E with Chairman Dodd Carr in the chair.

RESEARCH COMMITTEE PLANS PROGRAM

The Research Committee after welcoming its new members, proceeded to adopt the Research Program's operating budget for 1959-1960 which was later ratified by the Executive Board. Seven active Research Projects were continued for 1959-1960. It elected James D. Thomas, General Motors Corporation, as 1959-1960 Research Chairman succeeding Dr. Russel E. Harr, Western Electric Company, Chicago. Aside from conducting much other business important to AES's vital Research Program, it reelected Kergan Wells, Vice Chairman of Finance and elected Dr. D. G. Foulke as Vice Chairman for Research for 1959-1960. It warmly commended its retiring members, namely Dr. Harr; Leslie L. Diveley and Leland M. Morse.

EDUCATIONAL COMMITTEE MEETS LIBRARIANS

Having welcomed its new members, the Educational Committee plunged deeply into consideration of the 1959 Speakers List with the innovation of abstracts attending each covered speech title. It then joined with Branch

Librarians to conduct a resultful luncheon meeting in the English Room with AES First Vice President Ralph D. Wysong in the role of Chairman of the joint meeting.

LADIES VISIT RENOWNED PLACES

While many AES members journeyed to Dearborn, Michigan and inspected the impressive Rouge Plant of the Ford Motor Company, AES ladies, in large number, lunched at famed Dearborn Inn—enjoyed Oakite's Dave Clarin and his Aunt Ella Show—then toured Edison Institute and renowned Greenfield Village.

EXPOSITION MAKES GALA DEBUT

In Oak Park, Michigan, at AES's vaunted Fifth Industrial Finishing Exposition, that vast enterprise had its impressive Grand Opening Ceremony. And among the highspots of the opening day was the popularity experienced by the AES's FIFTIETH ANNIVERSARY LOUNGE featuring the exhibits of AES itself, its PLATING MAGAZINE and its Research Program. Many visitors signed the GOLDEN JUBILEE REGISTER that will be displayed at the Society's Diamond Jubilee in 1984.

A feature of the gala Exposition Opening was the ceremony unveiling a handsome portrait of the esteemed late Thomas A. Trumbour by MFSA Secretary A. P. Munning in the presence of the deceased's immediate family and a large circle of AES and MFSA dignitaries. The portrait was then prominently placed in the lounge of Metal Finishing Magazine and was viewed by the many friends of the man who did so much to found and develop both MFSA and the AES.

Educationally, Session D of the International Conference kept alive the Conference's amazing attendance record by drawing another capacity audience. This was one of the two International Conference Sessions held during the week at the Exposition.

WEDNESDAY, JUNE 17

Bright and early, AES's Ladies boarded the steamer S. S. Aquarama for a full day's happy cruise on handsome Lake St. Clair. Many of their menfolk, in turn, journeyed to the Pine Lake Country Club at nearby Pontiac and vied for honors in the Golden Jubilee Golf Tournament sponsored by the MFSA. Meantime, the Society's Membership Committee, with Chairman Manuel Ben presiding, attacked its heavy agenda at a breakfast meeting, then continued in executive session to noon.

MIDWEST REGIONAL COUNCIL MEETS

Simultaneously, the Public Relations Committee under Chairman Frank Tirendi conducted a full morning's meeting in the English Room. It welcomed its new members. Among other business transacted, it elected Robert M. Norton, Chairman and Eugene Roth, Vice Chairman. John P. Nichols, AES's public relations practitioner, continues as Secretary-Treasurer.

And in adjoining Parlor B, the Midwest Regional Council, with General Chairman Leslie L. Diveley presiding, held an important council meeting with all six signatory Branches represented, including Chicago, Milwaukee, Mississippi Valley, Rockford, St. Joseph Valley and St. Louis. An important item on its Agenda was planning the AES Annual Convention that will be conducted in Milwaukee, Wisconsin, in June 1962 under the aegis of the full Council but with Milwaukee as Host Branch.

AES MEMBERS TOUR CHRYSLER

Packed roomfuls of electroplaters and metal finishers interested in educational enrichment crowded the Grand Ballroom and the Michigan Room where Educational Session E and Educational Session F of the International Conference on Electrodeposition and Metal Finishing were respectively conducted. Meanwhile, many other AES members and guests took the opportunity that same forenoon to visit and tour the Chrysler Engineering Laboratory and gained maximum benefit from that educational experience.

BOOM TRAFFIC VIEWS EXHIBITS

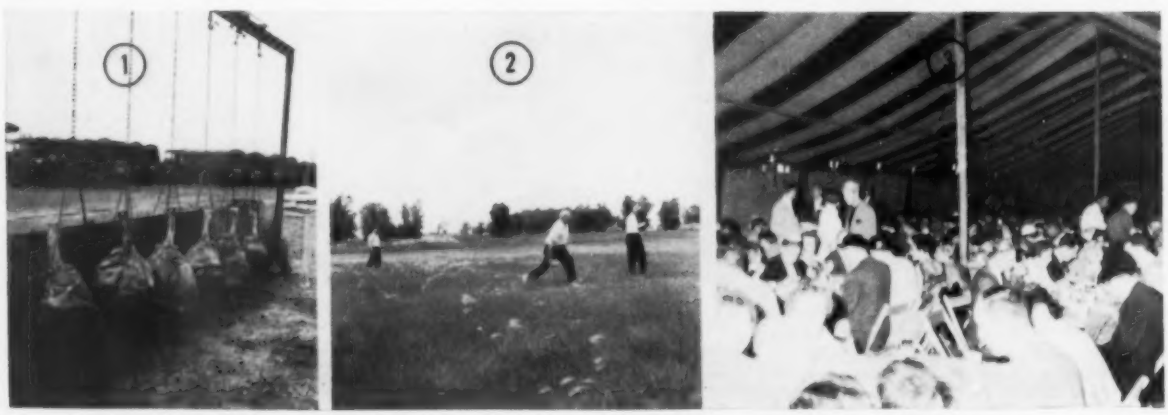
At the Artillery Armory in Oak Park, Michigan that same Wednesday, the Industrial Finishing Exposition enjoyed one of its "boom" traffic days. A host of interested spectators packed the Exposition's aisles and viewed and examined the exhibited equipment and processes of the many outstanding industrial companies participating in the Exposition.

Under Chairman Samuel Heiman, the Publications Committee held an important afternoon meeting in the Statler's Parlor B while the strong AES "East" baseball team engaged the vaunted AES "West" team in a climax game for the AES Golden Jubilee baseball championship. With Past President Arthur W. Logozzo on the mound, the "East" conquered the "West" by a 23 to 11 score.

MILLIONAIRES' PARTY AND OX BARBECUE

AES members and their ladies and guests then converged in late afternoon upon the Artillery Armory's spacious grounds for one of the relaxational features of the Golden Jubilee Convention, namely its "Millionaires' Party". Each person having been given veritably thousands of dollars worth of stage money with which to chance luck, AES's men and women and AES's younger set spent the balance of the afternoon vying at Race Horse, Big 6, Roulette, Klondike, Chuck-a-Luck, Razzle-Dazzle and other such enterprises, Monte Carlo style. Handsome prizes rewarded those who had competitively increased their stakes to the greatest extent.

The Millionaires' Party was in turn followed by Chairman Bob Dudley's "Ox Barbecue" under Michigan stars. Whetted appetites having been well satisfied, AES's old and young labeled the outdoor repast as among the finest yet served at an AES Annual Convention. Meanwhile



(1) Beef roasting to perfection for the Ox Barbecue on Wednesday afternoon. (2) "Dynamite" Logozzo hurls "East's" ball team to victory over "West" (3) A corner of the dining tent at the Barbecue.

EVENTFUL ANNUAL MEETING OF THE SUPREME SOCIETY

(1) President Head presents Honorary Membership Award to National Past President George P. Swift of Boston. (2) AES Delegates and Alternate Delegates in Supreme Society session. (3) National Past President Arthur W. Logozzo of Hartford, right, receives Honorary Membership Award from President Head. (4) Delegate H. R. Stoegner, Sr. accepts victorious Southeastern Branch's Membership Award from National Second Vice President W. Andrew Wesley. (5) President Head presents Award of Merit to Dr. D. Gardner Foulke. (6) Dr. Walter R. Meyer, another recipient of the AES Award of Merit. (7) Left to right, Past President Francis T. Eddy installing AES's newly elected 1959-1960 National Officers: President Ralph D. Wysong, First Vice President W. Andrew Wesley, Second Vice President Chester G. Borlet, Third Vice President Manuel Ben and Past President Herberth E. Head. (8) Retiring President Head receives plaque from President Wysong. (9) National Officers Pin being pinned upon new Third Vice President Ben by Past President Eddy. (10) Busy "Tellers" William C. Geissman (Rockford) and Louis V. Gagnon (Boston) tally the third vice president ballots. (11) Retiring President Head turns over the gavel to incoming President Wysong. (12) The new national president, Ralph D. Wysong, at the rostrum.

large traffic continued to view the exhibits of AES's exhibitors at its popular Industrial Finishing Exposition.

THURSDAY, JUNE 18

Educational Session G of the International Conference opened the day for those seeking technical knowledge while other AES members visited the renowned General Motors Technical Center at nearby Warren, Michigan. The Industrial Finishing Exposition continued to break traffic records. And the ladies brunched at Devon Gables in Bloomfield Hills, then were entertained at an Auto Styling Show and Tea at the Chrysler Corporation.

That same afternoon, a crowded Grand Ballroom participated in the International Conference Educational Session H. But for the governors of the Society, namely the accredited Delegates/Alternates composing the Supreme Society, AES's summit governing council, the entire day, from morning to late afternoon, was busily occupied by the Second Business Session of the Supreme Society.

GOVERNING COUNCIL'S CLIMAX MEETING

With National President Herberth E. Head in the chair, the Society's governing council's legislative actions of that meeting included the following:

1. The AES Constitution and Bylaws were appropriately amended to embody the following changes in the Per Capita Taxes annually paid by AES chartered Branches to the Supreme Society:

   For all Branches on the North American Continent, effective July 1, 1959 for the July 1, 1959-June 30, 1960 fiscal year and thereafter, the Per Capita Tax was increased from $5.70 to $7.50—a rise of $1.80 per Branch member.

   Exempt from the increase are the annual membership fees paid by Sustaining Members whose Per Capita Tax deduction continues at $4.70 of $100 per Sustaining Membership per fiscal year, with the $95.30 balance per each such annual membership earmarked for Research.

ROUNDUP OF AES PAST PRESIDENTS

A galaxy of AES Past Presidents assembled for a reunion dinner Monday, June 15. (Rear row, left to right) Past Presidents Neill, Head, Phillips, Swift, Caldwell, Fulforth and Eddy. (Second Row) Past Presidents Huston, Nixon, Heiman, Schaefer, Pinner, Conley and Musick. (Kneeling) National Officers Wesley, Wysong and Borlet.

Also exempt, naturally, from the Per Capita Tax increase are the AES's chartered Branches in Australia. These will continue to pay $5.70 (American money) per Branch Member per fiscal annum, but Australian Branches will be billed additional for air mailings or any other such special service requested.

2. By Supreme Society action, the annual membership fees of Members-at-Large were increased, effective July 1, 1959 for the July 1, 1959-June 30, 1960 fiscal and thereafter, to $11 per such member per fiscal year.

3. The annual due-date of all Branch Per Capita Taxes and Member-at-Large fees was advanced from December 1 to September 1 by enacted Constitutional and Bylaw amendment effective July 1, 1959. For the July 1, 1959-June 30, 1960 fiscal year only, however, all Branch Per Capita Taxes for that fiscal year will be due at National Headquarters on or before October 1, 1959 instead of on or before September 1. This concession for this one fiscal year only was made by the Supreme Society because of the time element involved in this due-date change.

4. The Supreme Society instructed the Executive Board to consult with investment counsel and ascertain as to whether there are desirably any even more productive recommended means of investing the Society's reserve funds. It directed the Board to act accordingly in the event of affirmative findings, and, in any case, to report to the Supreme Society on the subject at the Los Angeles Annual Meeting.

5. The Supreme Society empowered the Board to edit the official verbatim stenotype transcript of the Minutes of the Annual Meeting of the Supreme Society, and to issue to all accredited Delegates/Alternates and Branch Presidents and Branch Secretaries, a summarized version of those official Minutes instead of the complete transcript as heretofore.

6. The Supreme Society approved the Society/PLATING operating budget for the fiscal year (July 1, 1959-June 30, 1960) as submitted by the Executive Board. It embodies a budget of AES/PLATING operating expenses aggregating $256,025 for the July 1, 1959-June 30, 1960 fiscal year compared with the budget of combined operating expenses in effect for the fiscal year of July 1, 1958-June 30, 1959 totaling $233,940.

7. Apart from several corrective or clarifying amendments made in the AES Bylaws of relatively minor nature, the Supreme Society also altered policy thereby enabling it to select and fix Interim Meeting sites more than a year ahead. After accepting the Philadelphia Branch's invitation to host the Seventh Interim Meeting to be held early in 1960 in that city, it consequently also accepted the invitation of the New England Regional group to host the Eighth Interim Meeting in Hartford, Connecticut, in early 1961.

8. The Supreme Society, at that same Detroit Annual Meeting, elevated Past President George Parsons Swift of Boston and Past President Arthur W. Logozzo of Hartford, Connecticut, to AES Honorary Membership.

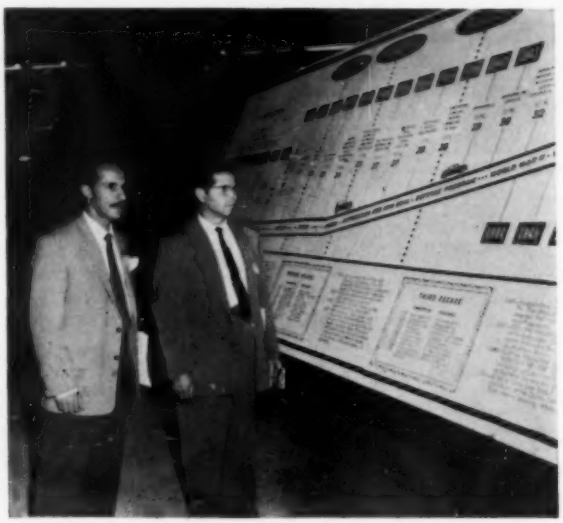
9. The Supreme Society unanimously supported the exclusive authority of the Executive Board to bestow Awards of Merit at its discretion. The Board then announced granting such Awards to John J. Dale of Australia, Dr. Walter R. Meyer of New Haven and Dr. D. G. Foulke of Newark.

10. The report of the Honorary Membership Awards Committee channeled to the Supreme Society by the Executive Board was approved by the Society encompassing revisions in the specifications for eligibility, and in the procedure for nomination and selection. These changes will be found elsewhere in this issue.

11. The Supreme Society adopted the specifications for AES's new "Charles Henry Proctor Memorial Leadership Award" submitted by the Executive Board, and it approved and instituted that Award as the Society's highest non-technical or non-scientific annual honor. It warmly thanked Mr. and Mrs. William O. Preston, the donors, for it, and announced that it will be bestowed for the first time at the Final Banquet of the Los Angeles Anual Convention in July 1960. Residents of Madison, New Jersey, Mr. and Mrs. Preston are the son-in-law and daughter respectively of the late Charles Henry Proctor, "father", in effect, of the AES.

12. It tabled the reports respectively of the "Appraisal Committee as to the Need for a Convention Planning Committee" and of the "Appraisal Committee as to the Need For and Duties of a Long-Range Planning Committee".

13. St. Louis was selected by the Supreme Society as site of the AES Annual Convention of 1964, and New



MEXICAN DELEGATION AT AES EXHIBIT

Viewing the "Kaleidoscope of AES's First Half Century," keystone exhibit in the AES's FIFTIETH ANNIVERSARY LOUNGE, are two interested stalwarts of the Mexican Delegation.

GOLDEN JUBILEE CONVENTION BANQUET, DETROIT, MICHIGAN

(1) Part of the banquet dais and nearby tables. (2) National Past President Herberth E. Head, Mrs. Head, Mrs. Wysong, National President Ralph D. Wysong. (3) President Wysong greets the banqueteers. (4) Dr. Simon Wernick, honorary secretary of the International Council, and John P. Nichols, AES national executive secretary. (5) Walter L. Pinner, chairman of the International Council. (6) Past President Head, Mrs. and President Wysong. (7) Convention General Chairman Wright W. Wilson and Mrs. T. P. Hoar. (8) President Wysong, Mrs. Wright W. Wilson, Dr. T. P. Hoar. (9) National Executive Secretary Nichols places documentary material in the "Golden Jubilee Box" to be opened at AES's Diamond Jubilee in 1984. President Wysong at the microphone. (10) Howard W. McAleer, chairman of the Industrial Finishing Exposition, reports on the Exposition.

THE 1959-1960 EXECUTIVE BOARD

The 1959-1960 Board meets in busy Friday, June 19 meeting to embark the AES on its fifty-first year. Left to right, Immediate Past President Head; National Executive Secretary Nichols; President Wysong; First Vice President Wesley; Second Vice President Borlet and Third Vice President Ben. And at right, the traditional President's Breakfast for National Officers and their families that preceded the Friday morning meeting.

York was chosen as locale of the 1965 Annual Convention.

14. Through a resolution prepared by Chairman Manson Glover of the Resolutions Committee, the Detroit Branch was heartily thanked and congratulated by the Supreme Society for an outstanding GOLDEN JUBILEE Convention, Industrial Finishing Exposition and International Conference on Electrodeposition and Metal Finishing with accolades given to General Convention Chairman Wright W. Wilson, Exposition Chairman Howard J. McAleer and International Conference Chairman Walter L. Pinner.

Ralph D. Wysong, Studebaker-Packard Company, South Bend, Indiana, was elected AES National President for 1959-1960 succeeding Herberth E. Head, Chrysler Corporation, Detroit, who continues as Immediate Past President on the 1959-1960 Executive Board.

The Supreme Society elected Dr. W. Andrew Wesley, International Nickel Company, Bayonne, N. J., as First Vice President; Chester G. Borlet, Grand Rapids Brass Company, Grand Rapids, Michigan, as Second Vice President and Manuel Ben, General Motors Corporation, Detroit, Michigan, as Third Vice President.

The elected 1959-1960 National Officers were installed by Past President Francis T. Eddy, who in retiring from Board membership after five years, was given a standing ovation as he took his place in the Waterbury Branch delegation.

President Wysong upon receiving his silver-plated gavel of office at the hands of his successor, in turn presented Past President Head with his Past President's pin and with a plaque symbolizing the Society's appreciation to him for an effective tenure as its head.

JUBILEE'S MEMORABLE FAREWELL BANQUET

Gaily bedecked, the spacious Grand Ballroom of the Statler-Hilton had been transformed into a brilliant banquet hall so as to set proper scene for the Society's memorable Farewell Banquet that Thursday evening. Receptions and cocktail parties, sponsored by the industry's major sources of supply, preceded the gala event.

The rendering of the National Anthems of the United States and Great Britain immediately followed the entrance of occupants gracing the head table.

Immediately after dinner had been served, General Chairman Wright W. Wilson, as Master of Ceremonies, introduced the dais thus starting the evening's program. Aside from Mr. Wilson, the assembly heard from Dr. T. P. Hoar, President of England's Institute of Metal Finishing. It also heard Exposition Chairman Howard J. McAleer; International Conference Chairman Walter L. Pinner; then from immediate Past President Herberth E. Head.

With appropriate ceremony, a Detroit Branch gift was presented to Mr. Head in appreciation for effective administration as President during the Society's Fiftieth Anniversary year.

The Chairman next called upon National President Ralph D. Wysong whose brief remarks were well received by the assembly.

JUBILEE BOX PRESERVES ARCHIVES

Introduced at this point was the Society's GOLDEN JUBILEE Box. President Wysong described its proposed service as official repository for the archives and memorabilia of the GOLDEN JUBILEE. As a token start, the official printed program of the GOLDEN JUBILEE Convention, Exposition and International Conference; the GOLDEN JUBILEE issue of PLATING MAGAZINE and the documentary booklet titled "Milestones of AES" were inserted into it, at the President's request, by National Executive Secretary Nichols. After all of the other proposed contents are added at Headquarters by Mr. Nichols for passage into posterity, the Box will be sealed and will not be reopened until the Society's Diamond Jubilee in 1984.

As requested by the President, Mr. Nichols then announced to the vast audience, the inauguration specifications of the new Charles Henry Proctor Memorial Leadership Award, donated by Mr. and Mrs. William O. Preston, son-in-law and daughter respectively of the late Mr. Proctor, that had been adopted by the Supreme Society that very day to serve as AES's apex annual leadership honor.

After the closing of the GOLDEN JUBILEE program, audience was treated to a star-studded floor show—then danced to the late hours.

FRIDAY, JUNE 19

The new President's traditional breakfast for National Officers and their wives was held early this forenoon followed by a full morning's busy meeting of the Executive Board. During it, the 1959-1960 Law Committee was appointed composed of Manson Glover as Chairman and including Past President William J. Neill and Myron Diggin. And as the Branch representatives on the new "Charles Henry Proctor Memorial Leadership Award Selection Committee", the Board appointed the Presidents of the Buffalo and British Columbia Branches.

General Convention Chairman's report to the Board announced GOLDEN JUBILEE Convention's registration attendance at 1846 subject to slight possible change at final audit. He reported that some 1610 attended the Farewell Banquet, and that the educational sessions averaged over 500 present daily. Plant tours averaged some 250 persons each.

The memorable FIFTIETH ANNIVERSARY Convention, Exposition and International Conference ended with a cited visit of the Ford Motor Company plant by the ladies—three packed final educational sessions, the last at the Artillery Armory—and the busy closing of the Exposition.

The AES's GOLDEN JUBILEE, observed dramatically and beneficially over a twelve-month span, culminated in a Convention, Exposition and International Conference that earned a proud niche in AES's long history. With this finale on Friday, June 19, 1959, the Society embarked upon its fifty-first year ready, willing and confidently able to meet the demands of the challenging tides and eddies ahead to its Diamond Jubilee in 1984.

AES LADIES AND THE GOLDEN JUBILEE CONVENTION

by
Frances M. Hoffman
(Mrs August R. Hoffman, Cleveland, Ohio)

Greetings to All! To the ladies who will delight in reliving the activities during the Convention and to the ladies who were unable to join us.

It was an impressive and long-remembered program which the Detroit ladies so carefully planned and executed during GOLDEN JUBILEE Week. And now, let's start with the Sunday afternoon tea, for that is the time the Ladies Program was really launched.

Mrs. Pillsbury, our gracious hostess and Chairman of the Ladies Committee, outlined the program for the week. Her Committee stood by to serve us the "tea goodies" and to radiate a feeling of friendliness and welcome which made us feel quite at home. It was a delightful party and a lovely way to start the week, thanks to Siefen Compounds, Inc. The "Golden Jubilee Get-Together" party Sunday night was again filled with laughter and handshakes, renewing old acquaintances and making new ones.

The Grand Opening Session on Monday morning really set the stage for the GOLDEN JUBILEE CONVENTION of the American Electroplaters' Society. The ladies attendance was the greatest ever. President Dwight Eisenhower's message, together with greetings from Lieutenant Governor Swainson of Michigan and Mayor Miriani of Detroit made everyone feel welcome and comfortable. Mr. Irving A. Duffy of Ford gave a very enlightening talk on the future of the plating industry.

LUNCH AT THE DETROIT YACHT CLUB

The ladies were then whisked off to the Detroit Yacht Club. The luncheon was delicious and the speaker was superb. Miss Irene Myers, supervisor of Womens Activities for the General Electric Company in Fort Wayne, Indiana, took us on a European tour with her 150 GE girls. Her account was unusually vivid and realistic.

Miss Myers urged women to cut three weeds out of their lives, namely, 1) Do not criticize, 2) *Forget* when once you forgive and, 3) Do away with self-pity. Miss Myers lecture was filled with humor but with many suggestions for better "group living." Thanks for it to the Allied Research Products and Pillsbury Chemicals.

The Golden Jubilee Open House Monday Night proved to be a "jolly" affair. The food was really tasty and everywhere, groups of people were having much fun during the evening. Dancing followed the supper hour and the music was heavenly! "Wee" hours of the morning "sneaked" up on the dancers. We were grateful for the evening to the Metal Finishing Suppliers' Association. As always, they stood by.

Tuesday was again an exciting full day. The ladies were taken to the Dearborn Inn where they were entertained by the Oakite Products, Inc. As usual, the Aunt Ella party was a huge success. We were all glad to see Dave Clarin much improved. Keep on getting better, Dave! The ladies were delighted with their bright, silky, flowing scarfs given to them by the Detroit Ladies. Mr. Clarin gave away gifts which came from foreign lands. The Detroit Ladies Committee collected nickels from all the Convention Ladies and purchased a unique wrist alarm clock for Dave. He didn't think the ladies could put anything over on him, but—they did!

Following this delightful luncheon, the ladies went on a tour of Edison Institue and Greenfield Village. This is indeed one of the world's famous historical spots. Much excitement was demonstrated on Tuesday evening at the Plato Party where many valuable prizes were given to the lucky ladies. A great deal of suspense and many anxious moments were witnessed during the evening. Joan T. Wiarda was again our hostess. Somehow, we couldn't think of a Plato Party without you, Joan! The shining gifts brought many "Oh's" and "Ah's." Thanks for them to Mrs. J. J. Siefen Stark.

Wednesday was indeed another delightful day, chuck full of surprises, water, sunshine and money. We left early in the morning on a cruise around Lake St. Clair on the S. S. Aquarama. This was truly a "sunny" cruise. The Detroit Ladies added much to the atmosphere on the boat by wearing "automobile" skirts and shared flowers with all the ladies on the boat. Plato, prizes and a "yummy" luncheon aboard the great ship Aquarama. Thanks to the J. J. Siefen Company and Northwest Chemical for a memorable day.

ATTEND OX ROAST

We then "bussed" to the Artillery Armory. Here we received "free" money, won many prizes and enjoyed a real old-fashioned Ox Roast Barbecue. There was plenty of space to be comfortable, plenty of tasty food, plenty of prizes. Most of all, plenty of people!

Thursday the ladies were treated by the Udylite Corporation. We enjoyed a "Champagne" Brunch at Devon Gables in Bloomfield Hills. This was a delightful affair. "And," said all the ladies, "what delicious food we had!"

We then hurried to the Chrysler Auto Styling Show and a refreshing "tea" was served to us. Then to our hotel to dress for the traditional Farewell Banquet, floor show and dance which were all "just right" for the GOLDEN JUBILEE CONVENTION. Did we cover all of these events on Thursday? Indeed we did! But, please! don't ask HOW we did it.

Friday ended a wonderful "Golden Jubilee Week." The Ladies got a deluxe tour at the Ford Motor Company followed by a lovely luncheon.

The "perfect" cool days made for a "perfect" Convention Week, crowded with pleasant events which will remain as memories.

Mrs. Pillsbury and her Ladies Committee did an outstanding job. They made us feel "wanted" at the convention and prepared that Golden Jubilee prize-winning recipe for the busiest, gayest and happiest convention. Their graciousness and hospitality were woven into a well-organized and happy program which they executed so efficiently. Each and every lady recognized the fact that Mrs. Pillsbury and her Committee demonstrated a feeling of warmth, patience, kindness and generosity, and were not only willing but anxious to make everyone happy. They worked so untiringly during each project and were so anxious to please us. We really had fun!

In behalf of all the ladies who attended this GOLDEN JUBILEE CONVENTION, may I extend to Mrs. Pillsbury and her able committee a most grateful "THANK YOU," and may it be resolved that their graciousness, hospitality and generosity be remembered as an important part of the GOLDEN JUBILEE CONVENTION.

DETROIT LADIES COMMITTEE THANKS . . .

The Ladies Convention Committee thanks heartily the following companies that contributed so greatly to the success of the Ladies Program of the GOLDEN JUBILEE CONVENTION:

Acme Manufacturing Co.
Allied Research Products, Inc.
Auto City Plating Co.
Automotive Rubber Co.
L. G. Belanger (Behr-Manning Co.)
Benchmark, Inc.
Chemical Processing, Inc.
Chrysler Corporation
Detroit Edison Co.
Douglas and Lomason Co.
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Ford Motor Co.
Formax Manufacturing Corp.
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Harshaw Chemical Co.
Heatbath Corporation
Hooker Chemical Co.
Houdaille Industries, Inc.
Howard Plating Industries, Inc.
MacDermid Western, Inc.
Metal and Thermit Corp.
Northwest Chemical Co.
Oakite Products, Inc.
Pillsbury Chemicals
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Ross Industries, Inc.
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Siefen Compounds, Inc.
Solventol Chemical Products, Inc.
Frederic B. Stevens, Inc.
Udylite Corporation
Westinghouse Electric Co.
Whitfield Chemical Co.
Wyandotte Chemicals Corp.

AES and PLATING MAGAZINE join in also extending appreciation to the foregoing.

GOLDEN JUBILEE "TECHNICAL PROCEEDINGS" BEING READIED

Embodying each of the 43 technical and scientific papers on electroplating, metal finishing, organic coating and allied arts prepared by experts of 9 countries and presented at the Fifth International Conference on Electrodeposition and Metal Finishing, educational sessions phase of the AES's GOLDEN JUBILEE Convention and Exposition held in Detroit June 15–19, 1959, the AES's widely awaited book, TECHNICAL PROCEEDINGS (Golden Jubilee Year Edition), is now in process of preparation. The transcript of the discussion that attended the delivery of each paper will also be included in that voluminous treasure chest of knowledge.

Every reasonable effort is being made to have the book (by far the largest ever published by AES) make its appearance by late Autumn 1959. A copy of the book will then issue to every AES member in good standing as at November 1, 1959. A limited quantity of extra copies will expectedly be available thereafter for sale to interested non-members on an international scale on a first come-first served basis so long as that supply lasts.

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Coffee Maker
Bernie Kumko, 853-1st St., N.W., Grand Rapids, Mich.
Coffee Maker
Hilary Bielicki, 19300 Filer, Detroit 5, Mich.
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Robert Tefft, 13901 Clifton Blvd., Lakewood, Ohio
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Peter A. Koley, 5408 Poppleton Ave., Omaha, Nebr.
Fry Pan
A. H. Beebe, 1700 Cherokee, Ann Arbor, Michigan
Toaster
W. A. Hopkins, 8150 Shawnee Run Rd., Cincinnati, Ohio
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Alice Buckingham, 16142 Warwick Rd., Detroit 19, Mich.
Waffle-Grill
Travis Bernstein, 917 Elm St., Beloit, Wisconsin
Waffle-Grill
Wm. M. Sivyer Jr., 5711 Drexel, Dearborn, Mich.

COMMEMORATIVE TUMBLERS:
Chas. J. Saporito, 1758 N. Natoma, Chicago 35, Ill.
John A. Villian, 1944 Granada, San Diego 2, Calif.
Howard Hindes, 51 Laurelwood Rd., Holden, Mass.
L. V. LaRou, 19345 John R., Detroit, Mich.
F. K. Lutz, 8 Johns Rd., Valhalla, New York
Wm. R. McRae, 19125 Filmore, Detroit, Mich.
Norm Matte, 369 McKay, Windsor, Ontario, Canada
D. J. Keely, 801 W. Stewart Ave., Flint, Mich.
Bernard Martin, 3070 Monticello, Cleveland Hts., 18, Ohio

OPPORTUNITY TO AUTHORS INTERESTED IN LOS ANGELES CONVENTION PARTICIPATION

Emphasis being placed in programming the AES's Annual Convention to occur in Los Angeles, July 24-28, 1960, is upon creating an educational program so significant and appealing, that few persons seriously interested in educational enrichment in electroplating, metal finishing, organic coating and other such subjects can afford to miss it.

Members or non-member authors of original, unpublished technical and scientific papers on electroplating, metal finishing, organic coating and allied arts wishing to be considered as prospective participants in that Los Angeles educational program are cordially invited to communicate either with Host Branch Educational Chairman Earl W. Arnold direct (Address: L. H. Butcher Co., 3628 E. Olympic Boulevard, Los Angeles 23, California) or through the Editor of PLATING MAGAZINE, 443-445 Broad Street, Newark 2, New Jersey.

The Editorial Board will consider the preliminary program at its meeting in September 1959. You are consequently urged to record your availability with Mr. Arnold forthwith. State your subject (and send a preliminary abstract if possible) but please do not submit any manuscript until after the full particulars as to specifications have been sent to you.

AES NEWS

AES TO MEET IN ST. LOUIS 1964, GOTHAM IN 1965

The Supreme Society, at its Detroit Annual Meeting June 18, applied, for the first time, the new policy that it embraced in Cincinnati last May of selecting Annual Convention sites six years in advance instead of four years as heretofore. It tapped the St. Louis Branch as Host Branch of the 1964 Convention and the New York Branch, AES's "Mother" Branch, as host of the 1965 AES Annual Meeting.

Hence AES will trek to the West Coast in 1960 for the Los Angeles Annual Convention—return to the East Coast in 1961 for its Annual Meeting in historic Boston—journey to the Middle West for its 1962 Convention in Milwaukee—proceed "down by the Sea in '63" for the Atlantic City Convention that year—meet in St. Louis in 1964—then move to Knickerbocker in 1965 for AES's Annual Convention in the Empire City of its creation.

And the Philadelphia Branch, observing its own Fiftieth Anniversary, will climax its celebration by hosting the SEVENTH INTERIM MEETING on dates next winter soon to be announced.

A year later, the New England Regional group, patriarch of AES's five existent regional bodies, will host the Society's EIGHTH INTERIM MEETING, with the Hartford Branch as host.

BRANCH PRESIDENTS NAMED TO PROCTOR AWARD COMMITTEE

As reported elsewhere in this issue of PLATING, the recently created "Charles Henry Proctor Memorial Leadership Award" is now AES's highest non-scientific, non-technical honor.

And to round out the 1959–1960 Selection Committee already composed of 1) the donors, namely Mr. and Mrs. William O. Preston, 2) the National President of the Society, 3) the National Executive Secretary, 4) the Chairman of the Research Committee and 5) the Chairman of the Order of Past Presidents, the Executive Board has now appointed to it, James Lee, President of the British Columbia Branch and Rolland E. Campbell, President of the Buffalo Branch.

AES HONORARY MEMBERSHIP ELIGIBILITY BASIS AMENDED BY SUPREME SOCIETY

Adopting a report of the Honorary Membership Awards Committee channeled to it by the Executive Board, the Supreme Society, at its Detroit Annual Meeting, abandoned the "point system" specifications for eligibility for Honorary Membership embodied in the Hazucha Report that it approved at its Cincinnati Annual Meeting in May 1958, and instead substituted the following effective June 18, 1959:

> "Honorary Membership may be granted annually provided there is a qualified nominee. The number of Honorary Memberships granted in any one year shall not exceed one per 2,500 members or a fraction thereof."
>
> "To qualify, a nominee must have served the National Society with great distinction. In considering nomination, Branch Delegates and the Honorary Membership Award Committee shall be guided by the nominee's activities along the following lines: 1) Service as a Delegate to the Supreme Society; 2) Authorship of papers published in Society publications; 3) Service in staging National Conventions; 4) Service as a National Officer; 5) Chairmanship of Committees or Boards established by the Executive Board or Supreme Society; 6) Service on Committees or Boards established by the Executive Board or Supreme Society; 7) Work in organizing and presenting courses in electroplating and metal finishing; 8) Active assistance in organizing a new Branch; 9) Outstanding representation of the Society with closely allied groups; 10) Any other distinguished service or contribution to the Society."

The full provisions will be carried as an Appendix to the up-to-date AES Constitution and Bylaws that will be published in the September Issue of PLATING MAGAZINE. The Honorary Membership Awards Committee that completed the approved report was composed of Past Presidents Kenneth M. Huston and Charles C. Conley together with Leslie L. Diveley and Louis V. Gagnon.

Myron B. Diggin

Manson Glover

William J. Neill

BOARD APPOINTS 1959-1960 LAW COMMITTEE

To head the 1959–1960 Law Committee, the Executive Board at its Detroit meeting, June 19, appointed Manson Glover of the Boston Branch, buttressed by AES Past President William J. Neill of the Columbus Branch and Myron B. Diggin of the Newark Branch. Mr. Glover was Parliamentarian at the Detroit Annual Meeting.

PROCTOR AWARD ESTABLISHED AS AES's HIGHEST LEADERSHIP HONOR

TAKING a place beside the "AES Scientific Achievement Award," the Society's highest scientific honor, and beside the "Carl E. Heussner AES Gold Medal", the AES's highest published paper award, the new "Charles Henry Proctor Memorial Leadership Award," effective June 18, 1959, has become the Society's top annual honor recognizing superior leadership performance by any AES member in good standing at any AES level.

To be awarded each year at the final Convention banquet by the donor if present otherwise by the National President of the AES, the new award is a memorial for the late Charles Henry Proctor, "father", in effect, of AES, established by his daughter and son-in-law, namely Mr. and Mrs. William O. Preston of Madison, New Jersey.

The specifications channeled to the Supreme Society by the Executive Board and approved by the Society's summit governing body at its Detroit Annual Meeting, June 18, 1959, include the following among other provisions:

1. That the Award shall be exclusively sponsored by Mr. and Mrs. William O. Preston of Madison, New Jersey.

2. That it shall be awarded annually to that member in good standing of the American Electroplaters' Society, Inc. (AES), regardless of whether or not a National, Branch or Committee Officer, who during the year, in the judgment of the Selection Committee, demonstrated the most outstanding leadership qualities among nominees by AES Branches and AES Committees in furthering the objectives of the Society or in enhancing its dignity, prestige or progress. Said qualifications, for judging by the Selection Committee, shall be documented as to specific act or acts, whether organizational, administrative, membership promotion, public relations, educational, management or other such elements, singly or collectively.

3. That the annual Award shall consist of a cash award of $150—plus a suitably inscribed and laminated scroll—plus suitable recognition in PLATING MAGAZINE and in TECHNICAL PROCEEDINGS.

4. That nominations for said Award shall be made by AES Branches and AES Boards and Committees.

5. That the Selection Committee shall be composed of a) Mrs. William O. Preston, the donor, and/or Mr. Preston, b) the President of the Society, c) the National Executive Secretary of the Society, d) the Chairman of the Order of Past Presidents, e) the Chairman of the Research Committee and f) two Branch Presidents to be selected annually by the Executive Board at its June meeting. Each member of the Committee shall have one vote. Any four affirmative votes shall constitute selection. Selections may be made at a meeting of the Committee or by Letter Ballot. The President of the Society shall be Chairman of the Committee.

6. The Presentation of said Award shall be formally made at the Banquet of the National Convention by the donor if present otherwise by the President of the Society.

In due course, every AES Branch and every AES Board or Committee will be given an opportunity to nominate candidates within a specified deadline date early in 1960.

AES'S 1959 SPEAKERS LIST ENROUTE TO BRANCHES

The 1959 AES Speakers List has been completed and copies will soon be enroute to all AES Branches in the United States, Canada and Australia to aid them in scheduling appealing Branch educational sessions. As an innovation, this list includes an abstract of each prospective talk titled therein.

The new Speakers List is the product of the Subcommittee on Speakers List of the AES's Educational Committee. The Subcommittee is composed of Chairman Rafael Diaz (Pittsburgh Branch); I. William Marcovitch (Philadelphia Branch); F. Wayne Martin (Boston Branch); Herman Tessman (Milwaukee Branch) and Richard O. Watson (Indianapolis Branch).

TO ALL BRANCH SECRETARIES

1. **The tenure of your accredited Branch Delegates/Alternates composing the Supreme Society expires at the first Branch meeting following the June 18, 1959 meeting of the Supreme Society. A list identifying and authenticating the Delegates/Alternates elected by your Branch for 1959-1960 tenure is due in the hands of the National Executive Secretary by not later than November 2, 1959. An official Return Sheet upon which to list your 1959-1960 Delegates/Alternates for accreditation by the Credentials Committee will shortly be sent to you. It requires signature of both the Branch President and Secretary.**
2. **The due-date of your Branch Per Capita Taxes at the new rate is October 1, 1959 for the fiscal year from July 1, 1959 through June 30, 1960.**
3. **Your Branch, via its accredited Delegates, will be invited to nominate any qualified member of the Society whom it chooses for consideration for the AES Scientific Achievement Award. Your choice must be supported by six copies of a statement of your nominee's qualifications. These are due in the hands of the National Executive Secretary by not later than October 15, 1959 by the Award's regulations.**
4. **Your Branch, via its accredited Delegates, will soon be invited to nominate any qualified member of the Society whom it chooses for consideration for AES Honorary Membership. Your choice must be supported by six copies of a statement of qualifications. These are due in the hands of the Executive Secretary by not later than November 15, 1959 by the rules of the Supreme Society.**
5. **Your Branch, through its President, will be invited to nominate any member of the Society whom it chooses for consideration for the Charles Henry Proctor Memorial Leadership Award. More information soon.**

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INTERSOCIETY NEWS

LEONARD HEADS NATIONAL ASSOCIATION OF METAL FINISHERS

A. T. Leonard

A. T. Leonard, president of Superior Plating, Inc., Minneapolis, was elected president of the National Association of Metal Finishers, at their annual convention in Detroit on June 17. Mr. Leonard succeeds George W. Taylor, president, Production Plating Co., Adel, Ga., as head of the NAMF.

Robert L. Giesel, president of Adolph Plating, Inc., Chicago, was elected first vice president, while Edward N. Marlette, president of Marlette Plating Co., Chicago, was named second vice president.

Re-elected to his fifth term as secretary-treasurer was Frank Kaiser, president of Long Island Mechanical Plating Co., Inc., Woodside, L. I., N. Y. Sal Novelli, partner of Service Plating Co., Brooklyn, N. Y., was named assistant secretary-treasurer.

Two new directors were elected. They are James E. Cogan Jr., president of Globe Electroplating Co., Philadelphia, and Charles T. Smith, works manager of Danbury Metal Finishing Co., Danbury, Conn.

ABRASIVE AND GRINDING FORUM

"The Challenge of Grinding in the Missile Age" was the highlight topic of a Grinding and Abrasive Forum successfully completed recently by The Garrett Supply Co.

The forum was conducted on four successive nights for several hundred guests from Southern California industries.

Carl Soderlund, consulting engineer from the Worcester, Mass., plant of the Norton Co., gave the principal talk. He discussed the latest wheel dressing and grinding techniques, adapting them to current problems presented by increased metal hardness and strict production requirements.

The forum program began on an informal note. Guests were shown various demonstrations, including the use of mounted cutoff wheels, operation of a barrel finishing machine with abrasives; disc grinding of welds.

NEW ASTM NATIONAL OFFICERS ELECTED

The 1959-1960 national officers for the American Society for Testing Materials were elected at the 62nd annual meeting in Atlantic City, N. J., June 21–26, 1959.

F. L. LaQue, vice president and manager, Development and Research Division, The International Nickel Co., was elected president. Miles N. Clair, president, The Thompson & Lichtner Co., is the new vice president. A. Allan Bates, vice president of research and development, Portland Cement Association, continues as senior vice president.

Elected for three-year terms on the board of directors were the following: A. B. Cornthwaite, engineer of materials and tests, department of highways, Commonwealth of Virginia; C. L. Kent, assistant director of technical services, The Jones & Laughlin Steel Corp., H. C. Miller, laboratory engineer in charge of the testing laboratory, Public Service Electric and Gas Co. (N. J.); C. F. Nixon, head, electrochemistry and polymers dept., Research Laboratories, General Motors Corp.; H. D. Wilde, research coordinator, Humble Oil & Refining Co.; and I. V. Williams, materials engineer, Bell Telephone Laboratories.

Elected for a two-year term, was Robert D. Thompson, chief development engineer for commercial and glass products, Taylor Instrument Companies.

F. L. LaQue has been a vice president of The International Nickel Co., Inc., and manager of its Development and Research Division since June 1954. He had previously been head of the Corrosion Engineering Section of that division since 1945.

A native of Gananoque, Ontario, Canada, Mr. LaQue received his degree of BS in chemical and metallurgical engineering from Queen's University, Kingston, Ontario, in 1927. He joined International Nickel's Development and Research Division that year and since has devoted his activities to the field of corrosion and corrosion-resisting materials. Under his leadership, the well-known corrosion testing stations of the company at Kure Beach and Harbor Island, N. C. were established.

He has been a member of the American Society for Testing Materials since 1935. In 1951 he delivered the Edgar Marburg Memorial Lecture on "Corrosion Testing." Mr. LaQue has served as vice president of the Society since 1957 and also has served on several Board of Directors' committees.

In 1949, Mr. LaQue was the recipient of the F. N. Speller Award in Corrosion Engineering of the National Association of Corrosion Engineers, of which he is past president.

He is vice president of the Electrochemical Society, a member of the American Chemical Society, American Society for Metals, American Association for the Advancement of Science, chairman of the Corrosion Research Council of the Engineering Foundation, and serves on visiting committees of the Massachusetts Institute of Technology and Case Institute of Technology. He also is a member of the advisory committee of the School of Metallurgical Engineering of the University of Pennsylvania, and a member of the advisory panel to the Metallurgy Division of the National Bureau of Standards.

Cleveland F. Nixon, as head of the electrochemistry and polymers department of GM is engaged in research and development work on adhesives, elastomers, plastics, and electroplating. He is a native of Pennsylvania. In 1919 he entered the University of Wisconsin where he became interested in electroplating through the influence of his professor in electrochemistry, Dr. Oliver P. Watts. Graduation with a BS degree in chemical engineering was followed by six years in the laboratory of the Western Clock Company, Peru, Illinois.

In 1929 he joined the Ternstedt Division of the General Motors as plating engineer. Later, as director of process engineering and laboratories and then as director of process development section, he was concerned with plating engineering, finishing with organic materials, die casting, and product and material testing. In January 1952, he was transferred to the research laboratories and assumed his present position.

Mr. Nixon has been a member of the American Society for Testing Materials since 1936. He has been active on ASTM Committees B-7 on Light Metals and Alloys, B-8 on Electrodeposited Metallic Coatings, D-20 on Plastics, and the joint ASTM-SAE Committee on Automotive Rubber.

He is also a member of the Society of Automotive Engineers, The Electrochemical Society, the American Electroplaters' Society, and others. He was president of the American Electroplaters' Society in 1951-52.

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The NATURE, CAUSE and EFFECT of the POROSITY in ELECTRODEPOSITS

IV. INFLUENCE OF GAS BUBBLES ON THE FORMATION OF PORES

by FIELDING OGBURN and D. W. ERNST*

One mechanism for the formation of a pore in electrodeposits involves the inclusion of a surface gas bubble. Whether the pore becomes continuous or bridged depends upon the relative rates of hydrogen discharge and nickel deposition. A cell is described which permits the observation of a simulated "cross section" of a nickel deposit while it is being formed. A series of photomicrographs obtained with this cell show the enclosing of a gas bubble.

INTRODUCTION

THE POSSIBILITY THAT SURFACE gas bubbles contribute to the porosity of electrodeposits is a consideration that has been rejected on several occasions. In their critical review of the literature on porosity in plated coatings, Thon and Addison[1] are quite firm in their rejection. They base their opinion on the facts that there is no evidence that increased hydrogen evolution results in increased porosity, and that porosity tests show pores to be randomly distributed over pitted and non-pitted areas, even though the pits are caused by gas evolution.

Thon and Addison were undoubtedly looking for the factors which initiate pore growth in the first layer of the deposit. Evidently they ignored the question of the factors which control the growth of a pore.

EXPERIMENTAL OBSERVATIONS

One approach to the study of porosity by Project 13 was to observe the growth of a nickel deposit in a simulated "cross section". The observations were made in the cell shown in Fig. 1. The cell had a concentric cylindrical electrode system and a transparent "Saran" bottom. The cathode (center electrode) was pressed down onto the thin Saran bottom. When placed on the metallograph stage, it was possible to observe plating taking place on the periphery of the cathode.

If the cell was operated at a low current density, the deposit grew thicker at a uniform rate with few visible defects. At high current densities, hydrogen was evolved in great excess and the deposit became rough and had poor adherence. The procedure followed was to increase the current density until hydrogen was evolved and then to decrease it slightly. This procedure permitted hydrogen bubbles to remain attached to the nickel surface.

Fig. 2 is a series of photomicrographs which illustrate how a gas bubble is enclosed by a growing nickel deposit. In Fig. 2A a hydrogen bubble is seen resting on the nickel surface. In Figs. 2B and 2C, both the deposit and the bubble have grown, while in Fig. 2D the deposit has grown over the bubble. At a point slightly above the plane of the picture, the bubble is not quite covered; but further deposition would eventually cover it. Therefore, whether a bubble is covered by the deposit or enlarges itself depends upon the relative rates of hydrogen discharge and nickel deposition. When a gas bubble is large enough to break away from the nickel deposit, it does so in such a manner as to leave gas in the pore formed by the deposit growing around the bubble. This effectively prevents electrolyte from entering the pore and deposition from occurring.

While most of the pores observed were larger (10 mils) than commonly observed on plated objects, some smaller (1 mil) pores were also observed. The experimental procedure differed greatly from typical plating procedures in several ways; however, the observations may indicate a general mechanism of pore growth.

Fig. 3 is a top view photomicrograph of a gas pit. The dark oval in its center is a pore which extends through the deposit to the basis metal. Several foils shown to be porous by the photographic method of Ogburn and Benderly[2] have this type of pore.

DISCUSSION

It is generally accepted that pitting, at least "gas pits", can be caused by the formation of gas bubbles on the cathode, and it is possible that this contributes to the formation of a variety of pits. Tucker and Beuckman[3] mention microscopic pits, Cymboliste and Salauze[4] discuss "blister pits" and Cymboliste[5] infers that all pitting is due to gas bubbles. The observations reported here indicate a possible gas discharge mechanism for the growth of pores as well as pits and points to the conclusion that gas discharge or bubble formation on the cathode may be a much more important factor than is generally realized.

A number of factors have been proposed as the cause of pores: inclusions in the basis metal, surface contours and other discontinuities of the basis metal, foreign matter in the bath that settles on the cathode, deposit nucleation at discrete points without complete lateral growth to fill in intervening spaces, etc. No

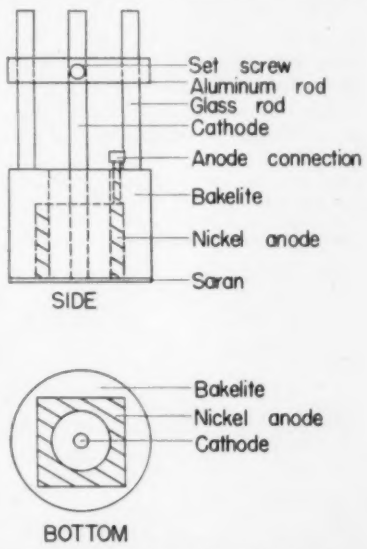


Fig. 1. Electrolysis cell used in observing the "cross section" of a nickel deposit during the deposition process.

* Chemistry Division, National Bureau of Standards, Washington, D. C., Project Director and Research Associate respectively of AES Research Project No. 13.

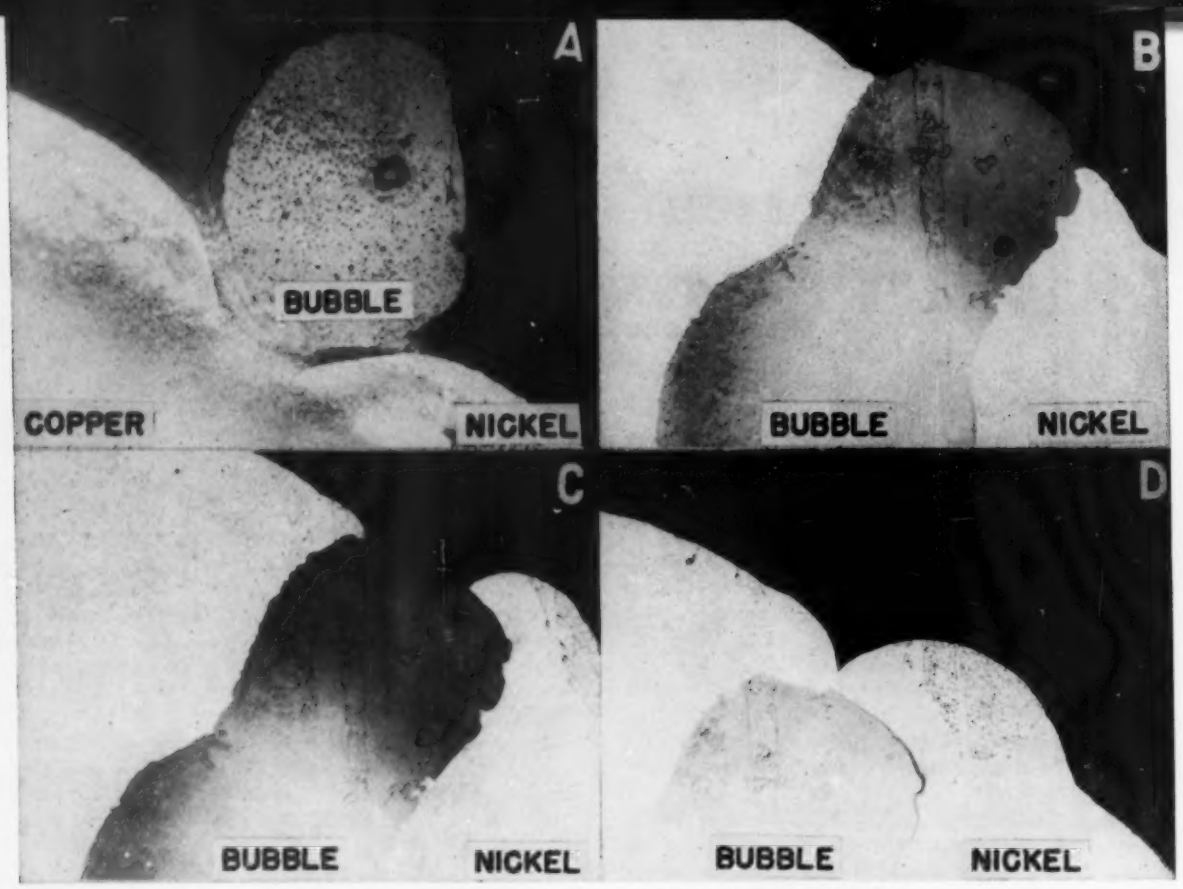
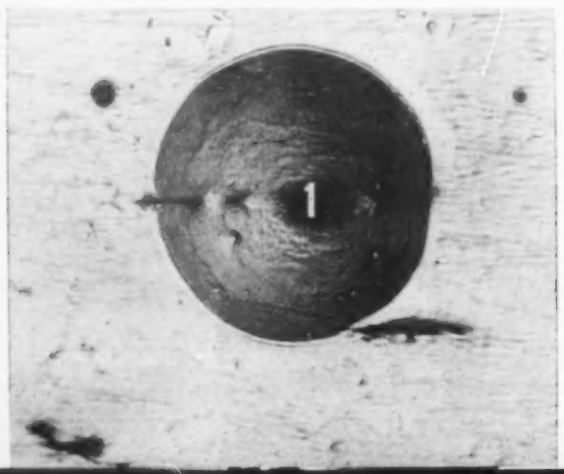


Fig. 2. Micrographs showing the formation of a void in a deposit (200 X).
A—Initial bubble on surface of the deposit B—C—Bubble partially covered by deposit D—Bubble completely covered by deposit

matter which of these initiates a pore or pit, once the pore has been initiated, subsequent deposition of nickel should normally bridge the pore; gradually, if not abruptly. Wesley[6] and Jones[7] observed this phenomenon and estimated that the thickness of the bridging deposit was 1.5 to 2 times the diameter of the pore, but they did not consider the presence of gas in the pore.

It is evident that a pore is not always bridged and that gas discharge or bubble formation offers a mechanism which easily accounts for continual growth of a pore. It seems likely that almost all pores follow the normal tendency to bridge. Those that are prevented from doing this by gas accumulation give the deposit its resulting porosity.

Fig. 3. Top surface view of a gas pit in a bright nickel deposit (400 X). The dark oval (1) in the center is the pore through which light passes. This is typical of most pores detected by the photographic method.



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Fielding Ogburn received a BS degree in 1941 from the University of Chicago, and is the assistant chief, Electrodeposition Section of the National Bureau of Standards. Mr. Ogburn is a member of the ACS, ASTM, serving as chairman, Subcommittee 1, Committee B-8; past chairman, Washington-Baltimore Section, Electrochemical Society. He is a Delegate and has served as Alternate Delegate, Secretary, Librarian and President of the Baltimore-Washington Branch, AES. Mr. Ogburn is Project Director of AES Research Project 13.

Donald W. Ernst received a PhD in inorganic chemistry and physical metallurgy from the University of Wisconsin in 1956, and since that time has been research associate for Project 13 at the National Bureau of Standards. Dr. Ernst is a member of AES, ACS, ASM, The Electrochemical Society, Phi Lambda Upsilon, and Sigma Xi.

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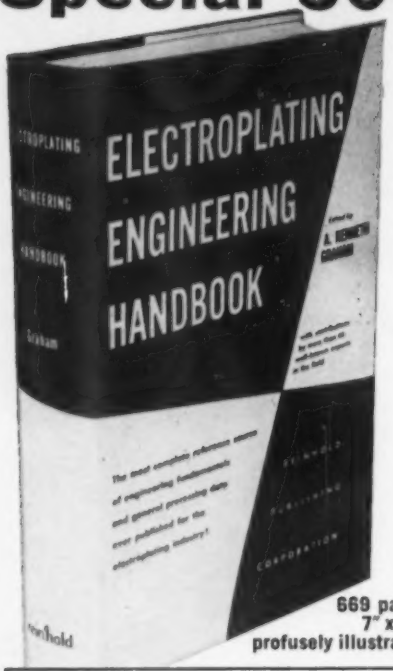

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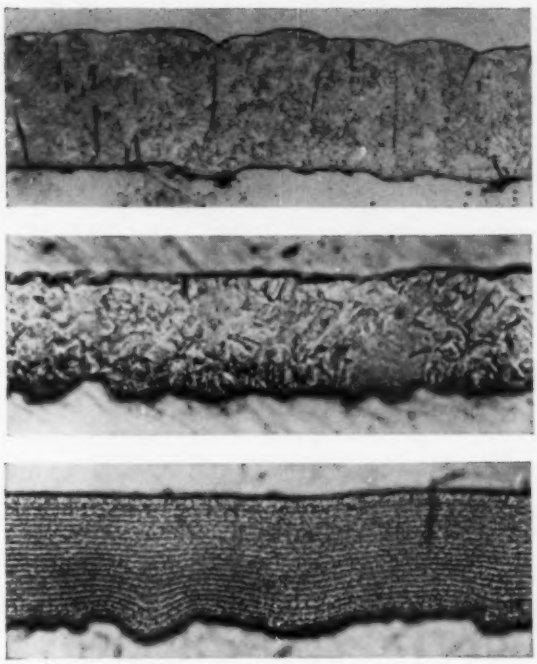

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INDUSTRY NEWS

ENGELHARD DEDICATES NEW RESEARCH LABORATORY

New Jersey Governor Robert B. Meyner on June 5 dedicated a new million-dollar research and development laboratory in Newark for Engelhard Industries, Inc., world's largest precious metals refiner and fabricator.

Speaking before about 300 persons at outdoor ceremonies at the laboratory in Delancy St., the Governor stressed Engelhard Industries' contributions to "areas of industrial opportunity in which our future as a State rests." He identified these as nuclear energy, synthetics, pharmaceuticals, petroleum, automation, and precision instrumentation.

Gov. Meyner called the Engelhard laboratory "another example of scientific progress in New Jersey." The state, he said, ranks as one of the foremost in the nation in research and development.

Charles W. Engelhard, chairman of the board of Engelhard Industries, Inc., in a welcoming speech said New Jersey's economic climate encourages growth and that the state is "rich in human resources."

"Research has played a premier role in our companies," Engelhard said. "The specialized skills developed here in the working of rare and precious metals are now being applied in new fields, of which atomic energy is an example."

Gordon V. Richdale, president of the corporation, discussed the international scope of the Engelhard organization, which in addition to the parent firm encompasses three other domestic companies and numerous overseas subsidiaries and associated firms.

He said the organization's growth "is the direct result of the unending search for new applications for precious metals."

Mr. Richdale attributed this growth in part to research programs carried out with other firms.

Dr. Edgar F. Rosenblatt, a senior vice president of Engelhard Industries, Inc. and director of research and development for the past 25 years, said the new laboratory "represents a gratifying sign of growth and expanding interest in science and new development."

"I believe that nowhere else in the world will be assembled such a relatively large number of scientific people devoted essentially to the study of the properties and uses of precious metals," he stated. He expressed pride in "the intensity of our study" and said "much new knowledge can finally flow from the research done in this new building to our country and to the whole world."

Projects in the laboratory, according to Dr. Rosenblatt, include study of the properties and refining of the platinum metals and their alloys, the effect of platinum metal catalysts on organic compounds, the use of platinum metals in petroleum chemistry, the surface conditioning of metals, platinum metals electroplating, electron microscopy, and spectroscopy.

The laboratory houses most of the Research and Development Division, one of 15 divisions of Engelhard Industries, Inc. It is divided into two departments, physics and chemical.

The Research and Development Division's library, one of the most complete chemical and metallurgical reference centers in the nation, is in the new building.

Eighty scientists and technicians work in the new laboratory. A staff of 20 remains in the Astor St. laboratory.

The new building contains 37,000 square feet of floor space, 30,000 of it occupied by the laboratory. It is on a site near the New Jersey Turnpike and commands a view of the New York skyline.

GUMM APPOINTS GEORGIA DISTRIBUTOR

Frederick Gumm Chemical Co. is pleased to announce the appointment of the Chemical Services, Inc., 1216 Zonolite Road, N.E., Atlanta 6, Georgia, as distributor of its products in the State of Georgia. Sales will be under the direction of Richard M. Jones and local sales personnel include William F. Crowell Jr. and James C. Baker of Atlanta, and Herbert W. Hatley of Chamblee, Ga.

KUSHNER ELECTROPLATING SCHOOL ACQUIRES NEW QUARTERS

The Joseph B. Kushner Electroplating School, home of the Electroplating Know How correspondence course in modern electroplating and metal finishing, has moved its offices to 621 S. Norman, Evansville 14, Ind. Its mailing address will remain as before, Box 2066, Evansville 14, Indiana. The move to larger quarters was made necessary by the acquisition of new equipment for printing student lessons and the need for additional space to store and handle student records.

The school also has announced that for the first time in eleven years it will be shut down for a vacation period this summer. The vacation period will be during the last three weeks of August and the first week of September.

SILVERCROWN DIRECTOR AMONG BRITISH VISITORS

George Schmerling, managing director of Silvercrown Limited, London availed himself of the opportunity, during his recent trip to the USA, to attend the International Conference, AES Convention and Exposition in Detroit, from June 15 to 19. Mr. Schmerling, a chemical engineer and Fellow of the Chemical Society, has been with Silvercrown for 20 years and was named managing director in 1955.

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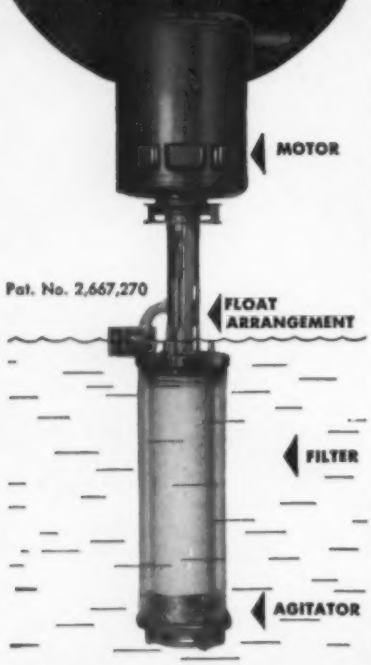

- ✓ Keeps Surface Clean Constantly Regardless of Solution Level
- ✓ No Solution Loss Due to Leaks . . . Most Important in Precious Metal Solutions
- ✓ Solution Agitation Built into Filter
- ✓ Entire Unit Submerged in Tank, Cannot Aerate Solution
- ✓ Requires Small Space in Tank . . . No Equipment in Aisles
- ✓ Large Filter Area at Low Cost . . . Easy to Clean
- ✓ Corrosion Resistant Construction Throughout

Exclusive National Sales Representative — THE CHEMICAL CORPORATION — makers of LUSTER-ON chromate conversion coatings for zinc, cadmium, copper, brass, aluminum.

Write for further information and name of your nearest distributor.

The Chemical Corporation

37 Waltham Ave. • Springfield 9, Mass.

966 INDICATE A 829.

was opened June 23, in Plainview, Long Island, N. Y. by Acoustica Associates, Inc.

Acoustica's new Plainview plant consolidates the company's executive headquarters and Eastern Division production and research operations which were previously conducted in 4 different plants.

The new building marks a milestone in the history of Acoustica's rapid expansion from its start only four years ago with 3 employes to its present position with more than 425 employes in its 5 plants located in Los Angeles, Culver City, and Santa Barbara, California; Hartford, Connecticut, and the new Plainview, N. Y. plant.

Robert L. Rod, president of Acoustica Associates, Inc., told the approximately 350 guests attending the ceremonies, that the new plant and other expansions of the ultrasonics industry will bring about major scientific breakthroughs during the coming year.

"This new plant," Mr. Rod declared, "portends vast improvements in ultrasonic equipment used for cleaning, liquid level measurement and control and for new applications."

PENNSALT EXPANDS SERVICE

A complete metal processing service, ranging from the design, installation and service of a variety of metal preparation and finishing machines to the compounds and chemicals themselves, is now being offered by Pennsalt Chemicals Corp. It is the most complete combined service ever offered through a single manufacturer.

The equipment in the Pennsalt line runs from small agitating washers and wash-and-rinse cabinets, the only standard models offered, to large phosphatizing machinery, spray coaters, dryers and other machines which are custom-designed.

INDUSTRIAL FILTER CONDUCTS SALES SCHOOL

Industrial Filter and Pump Manufacturing started its annual Sales Training School on Monday, June 1. Attending the series of lectures, movies, and demonstrations were representatives from most of the 49 states and several foreign countries.

James F. Zievers, vice president, made the opening address to this group. Following Mr. Zievers introduction Industrial's specialists in the fields of filtration and water and waste treatment gave lectures in their respective fields.

Other lecturers besides Mr. Zievers, for the company, were T. Sward, R. Riley, W. Wallin, B. Durham, F. Macioce, W. Engman, L. Danek, K. Odland, R. Baxa, R. Gray, S. Clements and R. Little. Assisting in the demonstrations was C. Novotny.

HYDRA-BLAST NEW DISTRIBUTORS

General Supply & Equipment Co., 15583 Brookpark Road, Cleveland 11, Ohio and Waldron Co., Inc., North Haven, Conn. have been appointed distributors for Hydra-Blast equipment and products.

THE UDYLITE COLOR TV PRIZE DRAWING

Immediately following the American Electroplaters' Society Convention and Exposition, Clyde H. Reeme, president of The Udylite Corporation, drew the winning ticket from the barrel containing the 800 individual tickets signed by customers in the electroplating field.

In the presence of Robert C. Trees, the director of advertising, the prize winning ticket signed by Lewis F. Dietrich, of the Ford Motor Company in Monroe, Michigan, was drawn by Mr. Reeme. Mr. Dietrich was immediately advised of his good fortune and the TV set was delivered and installed at his home.

Indian technician in attendance at the Sel-Rex booth of the United States Small Industries Exhibit during stopover in New Delhi, India.

WELDING FALL MEETING AT DETROIT

The American Welding Society fall meeting will be held in the Sheraton-Cadillac Hotel, Detroit, September 28 through October 1, 1959. Sixteen sessions will be held and a total of 48 technical papers will be presented. AWS headquarters are at 33 W. 39th Street, New York 18, New York.

HONORED FOR 50 YEARS IN PLATING

James F. Green, 2210 Grubb Road, was honored the first of June at dinner in a Wilmington, Delaware restaurant for his 50 years of service with the Speakman Company of that city.

Mr. Green, foreman of the plating department for many years until his health forced him to assume the less demanding duties of assistant foreman, joined the plumbing-hardware firm at the age of 14 on June 1, 1919, as helper in the plating department.

In his early years, Mr. Green recalls, the production line was simple. "Everything was cleaned by hand," he said. "Many times we walked in ankle-deep sawdust, used to soak up the water. Today, everything is highly mechanized."

Mr. Green born near Troy, N. Y., moved to Wilmington at the age of nine. He attended public schools and later studied plating chemistry at the Mastbaum Evening School, Philadelphia. He was graduated in 1939.

Mr. Green was a member of the Philadelphia Branch of the American Electroplaters' Society from 1925 to 1956.

Up until 1929, all Speakman brass showers and fittings were furnished in nickel plate. Mr. Green played a major role in research and development in 1929 when Speakman became the first in the industry to add chromium plating.

He and his wife have three daughters and eight grandchildren.

Among those at the testimonial dinner were members of the company board of directors and executive committee.

James H. Durnford, center, president of Oconomowoc Electroplating Co., Ashippun, Wis., congratulated on winning the prize of an automobile in the Metal & Thermit chromium-plating contest at the AES Exposition by Henry Mahlstedt, plating products manager, and H. W. Buchanan, general sales department sales manager, of M & T.

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BRASS PLATING

●

If you want to read you can get any answer you want on brass plating. If you want merely to do good consistent brass plating with the same color week in and week out with the ability to promptly make necessary corrections then all you need are the technical bulletins on brass plating we publish and a supply of the proper Brass Maintenance material. We have the experience and can offer the real know-how you need.

●

There are a lot of ways to do brass plating and no single way to achieve a desired finish. Much brass plating is done by merely a flash over bright nickel and this works well for wire goods. It is also possible to put the brass directly on the base and to bright dip a heavy brass plate. If you want good corrosion resistance lacquer will usually be the answer over the brass but if abrasion is present the answer is to zinc or cadmium plate first and then brass plate.

●

Both barrel and still tanks can use the same techniques. The solutions are operated almost alike but contrary to general practice it is better to operate still tanks at a slightly lower concentration than barrel solutions. The same True Brite Brass Maintenance solution is used in both cases.

●

It takes years to build up the experience to know brass plating so that it is a scientifically controlled solution. It takes a manufacturer of copper and zinc cyanide (which we are) to bring you Brass Maintenance solutions you can afford to use.

●

Send for our bulletins on Brass Plating, Richlow Brass Plating and Analysis of Brass Plating Solutions.

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INDUSTRY NEWS BRIEFS

COMMERCE DEPARTMENT PUBLISHES DIRECTORY OF TRANSLATIONS

The Department of Commerce has instituted publication of a periodical planned to serve as a central source of information in the United States on technical translations available to science and industry.

The periodical, *Technical Translations*, is being published twice a month by the Office of Technical Services, in cooperation with the Special Libraries Association. It lists and abstracts translated material available from U. S. Government sources, SLA, cooperating foreign governments, educational institutions, and private sources.

The Office of Technical Services was authorized by Congress to serve as a national "clearinghouse" for technical and scientific translations. For over 13 years, the Office has been collecting, cataloging, reproducing and distributing to science and industry the technical reports growing out of U. S. Government-financed research. These functions were expanded by the Congress to include scientific and technical translations, prepared by agencies of the Federal Government and other organizations.

AMERICAN PIPE AND NUKEM MERGE

American Pipe and Construction Co. of Monterey Park, Calif. and Nukem Products Corporation of Buffalo, N. Y. have completed a merger designed to provide increased facilities on two coasts for the activities of each company in the field of corrosion-resistant products.

Under the new arrangement, Nukem will be closely allied with Amercoat Corporation, an American subsidiary headquartered in South Gate, Calif.

Plans are already under way to expand facilities at South Gate and Buffalo to give Nukem and Amercoat dual manufacturing and warehousing bases.

General direction of both Amercoat and Nukem will be unified under G. E. Seidel, executive vice president of Amercoat, while John W. Chandler, formerly president of Nukem, will retain direct responsibility for the operation of the Buffalo plant and the sales of Nukem products.

TITANIUM GAINING IN NON-DEFENSE APPLICATIONS

Writing in the July 10, 1959 issue of The American Metal Market, Frank H. Vandenburgh, president of Mallory-Sharon Metals Corp., Niles, Ohio, stated in part:

"Probably the biggest single reason for titanium's strong showing this year in commercial applications is its extraordinary resistance to most forms of corrosive attack. In chemicals, food processing, plating and anodizing and pulp and paper mills, specification of titanium components is proving far more economical, because of the substantial reductions in maintenance and down-time costs often encountered in corrosive situations. . . .

"Titanium is also making substantial inroads into the metal treating field, primarily in anodizing, where titanium is more than justifying its costs through longer rack life and the elimination of the customary stripping cycle necessary with other metals. . . ."

HANSON-VAN WINKLE-MUNNING APPOINTS AUSTRALIAN AGENTS

Glen Walker & Company Pty. Ltd., Melbourne, Australia, have been appointed sole Australian agents for the Hanson-Van Winkle-Munning Co. H-VW-M addition agents will be produced in Australia by Glen Walker, the first Australian company to manufacture electroplating materials under license to a foreign firm.

PATENT ABSTRACTS

DR. D. GARDNER FOULKE
Manager, Electrochemical Development
Hanson-Van Winkle-Munning Co
Matawan, New Jersey

Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.

No. 2,854,367, 9/20/58—Phosphating Treatment—B. Tuttle *et al*, assignors to Second Bank-State Street Trust Co., Boston, Mass.

Phosphate coatings are subjected to immersion in a solution containing 0.1 to 50 parts by weight of a stannous salt and a water soluble polyhydroxy aliphatic acid.

19 claims.

No. 2,854,368, 9/30/58—Phosphating Solution—L. Shrier, London, England.

The solution claimed as able to form protective coatings on metals consists of 1 to 8 moles/l of phosphoric acid and a tannin material from 1 to 35 per cent by weight. Tannin sources given are Chinese gall, myrobalan, sumac, etc.

19 claims.

No. 2,854,369, 9/30/58—Increasing Solubility of Phosphating Accelerators—M. Kronstein, assignor to Oakite Products, Inc., New York, N. Y.

The use of formamide and alkyl substituted formamides as increasing the solubility of vanadic, tungstic and molybdic acids in phosphating baths.

7 claims.

No. 2,854,370, 9/30/58—Phosphate Coating—M. Kronstein, assignor to Oakite Products, Inc., New York, N. Y.

An accelerator for phosphating baths is described as an unsaturated alcohol containing at least one triple bond. Methylpentynol, butyndiol and propargyl alcohol are mentioned.

10 claims.

No. 2,854,371, 9/30/58—Treatment for Magnesium—S. Schjelderup, assignor to Shawder Bros., Inc., Denver, Col.

The solution for treating magnesium articles is described as containing 20 to 170 g/l of CrO_3, barium nitrate in excess of solubility and a strong acid sufficient to adjust the *p*H between 0.9 and 2.5.

15 claims.

No. 2,859,132, 11/4/58—Gas Plating—L. Novak and H. Homer, assignors to Commonwealth Engineering Co., Dayton, Ohio.

Bright smooth deposits of metal are claimed by bringing the metal bearing (heat decomposable) gas into contact with the article along with a gaseous brightener compound containing nitrogen (ammonia, methenamine, nitrous oxide, ammonium hydroxide).

See also No. 2,859,130 assigned to Commonwealth describing gas plating on synthetic fibers with 1 claim and figure.

16 claims.

No. 2,859,144, 11/4/58—Protective Coating for Aluminum—B. Jeremais, assigned to Poor and Company, Chicago, Ill.

A chromate coating bath for aluminum consists of chromic acid (0.5 to 5.2 g/l) and fluoboric acid (mol ratio H B F_4:CrO_3 is 1:16 to 2:1). The *p*h is 1.3 to 2.5.

See also No. 2,859,147 describing an aluminum coating composition containing chromic phosphoric acid a complex water soluble acetate and fluoboric acid in 14 claims.

12 claims, 4 figures.

No. 2,871,171, 1/27/59—Plating Copper on Aluminum—J. Atkinson, assignor to Her Majesty the Queen (DND).

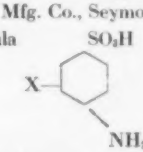
After cleaning immerse the aluminum article in a copper bath at *p*H 5 to 6.5, containing 10 to 60 g/l of bivalent copper (as Cu O), about 50 to 300 g/l of soluble pyro-or polyphosphate (as ammonium pyrophosphate), about 30 to 180 g/l of soluble oxalate (as oxalic acid) and 25 to 150 g/l of a basic cation ($N H_4$+), tertiary alkylamines) and plate at 5 to 30 asf at 30–90C.

See also No. 2,871,172 by same inventor with 7 claims, describing use of citrates and fluoride in the bath.

5 claims.

No. 2,871,173, 1/29/59—Ductile Copper Plates—E. Castellano, assignor to Seymour Mfg. Co., Seymour, Conn.

Compounds of formula



where X may be H, halogen and alkoxy are described as an addition agent for acid copper baths.

7 claims.

(Continued on page 984)

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SELECTED BOOKS ON ELECTROPLATING, METAL FINISHING AND RELATED SUBJECTS AVAILABLE FROM AMERICAN ELECTROPLATERS' SOCIETY, INC.

443-445 BROAD STREET, NEWARK 2, NEW JERSEY

	Non-members	AES Members
Electroplating Engineering Handbook.... Edited by A. Kenneth Graham. 650 pages.	$10.00	$ 6.00
Principles of Electroplating and Electroforming..... by William Blum and George B. Hogaboom. 455 pages.	8.00	6.95
Modern Electroplating..... by Allen G. Gray. 563 pages.	9.50	8.25
Protective Coatings for Metals. 2nd edition by R. M. Burns and W. W. Bradley. 643 pages.	12.50	10.50
Analysis of Electroplating and Related Solutions—2nd edition, 1958..... by K. E. Langford. 423 pages.	9.00	7.20
Chromium Plating..... by P. Morisset, J. W. Oswald, C. R. Draper and R. Pinner. 611 pages.	11.00	9.50
Electrochemistry—Principles and Applications..... by E. C. Potter.	10.00	8.35
Handbook of Practical Electroplating..... by Thomas M. Rodgers.	8.50	7.10
Electroplating for the Metallurgist, Engineer and Chemist..... by J. B. Mohler and H. J. Sandusky. 257 pages.	5.00	4.50
Surface Treatment and Finishing of Aluminum and its Alloys..... by S. Wernick and R. Pinner	13.25	11.95
Vapor-Plating..... by C. F. Powell, I. E. Campbell and B. W. Gonser—158 pages.	5.50	4.60
Hot Organic Coatings. 225 pages..... by Raymond B. Seymour.	7.50	6.25
Handbook of Barrel Finishing..... by R. Enyedy.	8.25	7.00
Coated Abrasives—Modern Tool of Industry..... Coated Abrasives Manufacturers' Institute.	8.50	7.10
ASME Handbook—Metals Engineering Processes..... Edited by Roger W. Bolz	13.50	11.25
Statistical Analysis in Chemistry and the Chemical Industry..... by C. A. Bennett and Norman L. Franklin	9.50	8.10
Principles of Industrial Waste Treatment... by C. Fred Gurnham.	9.50	8.10
Industrial Wastes—Their Disposal and Treatment..... Edited by W. Rudolfs.	9.50	8.10
Procedures for Analyzing Metal-Finishing Wastes.....	1.00	1.00
43rd Annual Technical Proceedings, American Electroplaters' Society—1956. Convention papers plus discussions....	12.50	12.50
Foreign.....	15.00	15.00
44th Annual Technical Proceedings, American Electroplaters' Society—1957. Convention papers plus discussions...	10.00	10.00
Foreign.....	12.50	12.50
45th Annual Technical Proceedings, American Electroplaters' Society—1958. Convention papers plus discussions...	12.00	12.00
Foreign.....	15.00	15.00
Specifications and Tests for Electrodeposited Coatings, 1958..... Standards of ASTM Committee B-8.	2.25	2.00
Control in Electroplating—Symposium.... Institute of Metal Finishing, England. Papers by K. E. Langford, T. E. Such, C. F. Corfe and D. W. Smith. 92 pages.	2.50	2.00
Effect of Surface on the Behaviour of Metals Papers by G. L. J. Bailey, T. P. Hoar, F. T. Barwell and R. W. B. Stephens. 100 pages.	10.00	8.35
Paint Finishing in Industry..... by A. A. B. Harvey. 516 pages.	12.00	9.60
The Structure of Steel..... by Edwin Gregory and Eric N. Simons. 176 pages.	10.00	8.35
New Instrumental Methods in Electrochemistry..... by P. Delahay. 455 pages.	13.00	12.00
Semiconductor Abstracts—Compiled by Battelle Memorial Institute, Sponsored by The Electrochemical Society..... Volume IV—1956. 456 pages.	12.00	10.00
Aluminum Paint and Powder—3rd edition. by J. D. Edwards and R. I. Wray. 228 pages.	5.50	4.60
Electroanalytical Chemistry..... by J. J. Lingane. 683 pages.	13.05	12.55
Chromium—Two Volumes. Both..... Edited by Marvin J. Udy. 857 pages.	19.50	16.55
Volume 1—447 pages.....	11.00	9.35
Volume 2—410 pages.....	11.00	9.35

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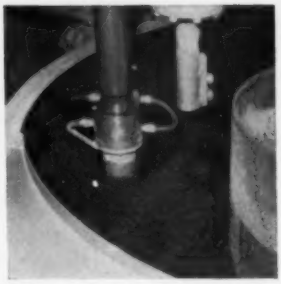
Here's how ALMCO's New Spindle Finishing Process gives precision finishing of complex components...

1 Operator air-chucks part to be finished to spindle after having just released the finished part.



2 Part is lowered into high velocity stream of abrasive media. Spindle rotates while in stream.

3 Index head carries spindle thru tub of abrasive media until it again reaches operator's station. Water rinses media away.

4 Result: fast and even action! In most cases, 0.005 to 0.015-in. radii can be generated on hardened gear teeth in 2-4 mins.

...and on a continuous production line basis!

The ALMCO Spindle Finishing Process now makes possible precision finishing of complex, high-quality components such as gears, bearing cages, spline shafts, pump rotors, jet blades, etc. . . .

- *at production rates heretofore not possible . . .*
- *on a continuous production line basis . . .*
- *and with all surfaces receiving the same controlled amount of precision finishing!*

Here's how it works. Large parts or clusters of smaller parts are chucked directly to the spindles from a single operator's work station. Spindles lower the parts into a high velocity stream of abrasive media contained in a tub that rotates at a controlled speed of from 275 to 600 sfpm at the spindle center line. Spindles themselves also rotate at 13 rpm while in the abrasive stream, while the indexing head slowly carries all spindles in a 1 to 9 minute trip around the tub. Operator merely removes and replaces parts on spindle chucks as they appear before him.

Models are available with automatic or manual indexing, 2 to 16 spindles, tub diameters of 48" to 90", and drives of from 5 to 30 hp.

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TRADE LITERATURE

L—801. Industrial Finishing Wall Chart—A handy colored wall chart lists specifications in quick reference form on: (1) Die Barbering Wheels; (2) Sticks, Stones and Rubs, and (3) Finishing Compounds. Pictures of products supplement the mathematical data. The chart is being made available, by The Carborundum Co.

L—802. Metal Cleaning. "Your Guide to Effective, Economical Metal Cleaning," a series of charts in file-folder form, is available.

Covering the typical problems involved in soak cleaning, steam gun cleaning, spray washing machine cleaning, and electrocleaning, the heavy-stock, six-page bulletin M240 has been designed by Magnus Chemical Co. for easy filing as a readily available source of cleaning information.

L—803. Vacuum Metallizing Spray Coatings—A new 18 page booklet on "Vacuum Metallizing Spray Coatings" has been published by the Logo Division, Bee Chemical Co. Spray coatings for use in conjunction with metallizing thermoplastics, thermosetting plastics, metals and glass are covered. Base coats for use before metallizing as well as top coats and back-up for use after metallizing are included along with other information on the metallizing operation.

L—804. Plating Waste Data Sheets—Cochrane Corporation has available three data sheets on plating waste. Data Sheet No. 1 surveys general plating room waste problems and describes briefly waste treatment processes, plus flow charts. Sheet No. 2 describes procedure used to predict the quantity and composition of wastes from proposed metal finishing operations, contains data on dragout and evaporation losses, and rinse requirements. Sheet No. 3 gives procedure to measure the quantity and composition of wastes from operating metal finishing rooms.

L—805. Immersion Heaters—GEA-6305A is a two page bulletin telling how to select General Electric immersion heaters.

Three sections of this illustrated bulletin tell how to determine which type of heater to use and how to select thermostats and controls for controlling liquid temperatures. Third section shows a typical wiring diagram for thermostat and for magnetic switch controls.

A simple five-step formula is outlined in the first section for easy selection of proper heater. Table lists amount of kilowatts necessary to heat liquid to desired temperature in one hour.

L—806. Water Heaters—Five sizes of vertical controlled draft water heaters are listed and described in Bulletin 5214 of Sellers Engineering Co. These high capacity large volume water heaters are explained in detail, including design features, accessibility; also, the difference in direct and indirect types of the vertical heater are set forth with suggestions for selection of proper model.

L—807. Rhodium Plating—The 20-page, fully illustrated booklet Rhodium Electroplating Processes, has been revised and reprinted by Sel-Rex Corporation.

The booklet tells when, where and how to use rhodium electroplate to improve product performance and reliability in electrical, electronic and other industrial applications. A wide range of rhodium's decorative applications are also discussed and evaluated.

Essentially a technical exposition of rhodium's unique metallurgical properties, the copyrighted booklet features graphs and charts showing rates of deposition under various operating conditions. Some of the detailed information contained includes: bath preparation and control of several different rhodium plating formulations; determination of rhodium in plating solutions; equipment required; current densities recommended and general operating instructions. The revised edition also includes a special "calculator" chart which permits quick, easy computation of rhodium electroplating costs.

L—808. Paint Strippers—A 5-page paper on paint removing compounds is available to the finishing field from L. R. Kerns Co. Included in the comprehensive report is a chart for correct stripper selection. The paper gives a description of the general types of paint strippers, recommendations for their use, and case history information from the appliance and metal products industry.

L—809. Finishing Cost Guide—An informative new cost guide is now available to manufacturers of products fully or partially fabricated from metal. It is known as the Metal Parts Finishing Cost Guide and is especially designed for determining and comparing costs involved in metals finishing procedures: (1) on premises finishing of parts, (2) off premises finishing of parts, and (3) use of prefinished metals.

Correctly used, the guide can be of invaluable assistance in pin-pointing production cost savings. Comparative figures are confined to the individual operation or sequence of operations for which the guide is used. They take into full account not only raw material prices, but also hidden costs and unrecognized expenses that are frequently overlooked when comparing metal finishing costs.

L—810. Heat Exchanger—A bulletin containing photographs, drawings, and capacity charts describes impervite modular exchanger system for heating or cooling corrosive solutions.

This system of Falls Industries, Inc. permits continuing flexibility in capacity and application.

It is composed of basic units, each consisting of two connected concentric pipe sections, mounted in steel stacking plates.

L—811. Water Treatment—A 24-page booklet presenting the latest developments in water treating equipment has been released by Elgin Softener Corp. The newest in manual and automatic zeolite water softeners, demineralizers and deionizers, dealkalizers, ion exchangers, filters, purifiers, aerators and degasitors are described. Also covered are spray and tray type deaerating heaters and water treating chemicals for every need.

L—812. Mechanical Finishing—A new 30 page catalog on precision mechanical finishing and automatic finishing processes is now available from the Roto-Finish Co.

The catalog outlines in detail the various types of finishing and abrading processes such as grinding, deburring, descaling, and polishing. It also explains how radii can be broken and the fatigue resistance of metal parts strengthened through mass production finishing techniques.

Included are illustrations and detailed descriptions of the various conventional models as well as the automatic finishing machine, and the newly developed Vibratron which employs a vibratory abrasive action. Dimensions, capacities, and recommended usage of the various types of equipment are also included.

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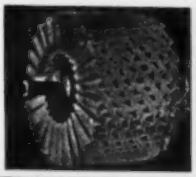

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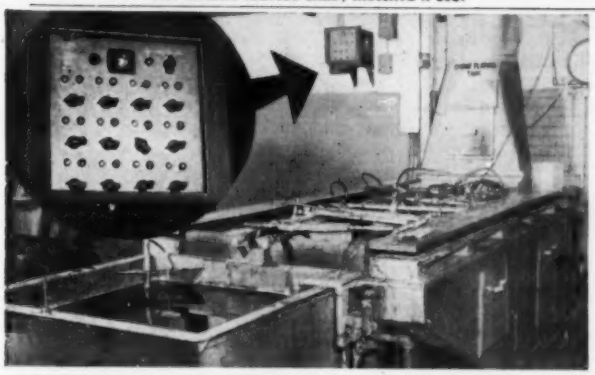

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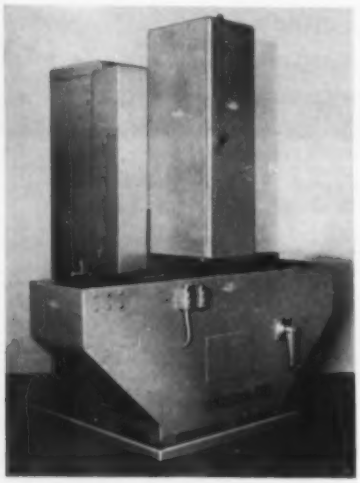
EQUIPMENT AND SUPPLIES

E—801. Filter Pumps—An addition to its line of portable "canned" filter pumps is the new all stainless steel SEI series introduced by Sethco Mfg. Corp.

Especially recommended by the manufacturer for filtering solvents, ultrasonic cleaners and precious metal solutions, these filter pump units are fabricated entirely of stainless steel 304, with the pump, motor, filter chamber and filter tube all housed in one unit.

A principal feature of the series is a pump which is inside a motor housing and magnetically driven by the motor. Stuffing boxes, rotary seals, shaft wear, coupling and alignment problems are said to be eliminated. The results claimed are long leak-proof, maintenance free operation.



E—802. Abrasive Belt Finishing Machines—A new line of machines that perform abrasive belt grinding, polishing and deburring operations on flat surfaces of bars, strips, coils, blanks, extrusions, stampings, forgings, die castings and sand castings up to 15-in. wide and 8-in. thick is announced by Acme Manufacturing Co.

Made in two models, the KC with a conveyor belt feed, and the KP with a pinch-roll feed, the machines will finish parts made of metal, plastic, ceramic, wood or rubber. Practically any flat surface that requires a finish, needs sizing or has to be deburred, descaled or snagged can be handled on these versatile machines. Tandem arrangements of either of these models can be made using as many units as necessary to produce the required successive grit finish.

E—803. Water Displacer—The announcement of a new, improved formulation for Enthone Water Displacing Liquid No. 1, an organic solvent used for rapid shedding of water from metals, has been made by Enthone, Inc., subsidiary of American Smelting and Refining Co. This liquid promotes rapid drying of metal parts by penetrating into crevices and holes and forcing water from the surface. The water settles to the bottom of the liquid and can be drawn off periodically.

In the new formulation, the rate at which the displaced droplets of water settle to the bottom of the tank has been greatly increased without sacrificing the very fast water shedding rate, according to Enthone.

This solvent is used for drying of parts after plating, pickling, coloring, cleaning, etching and phosphating.

E—804. Deburring and Finishing Barrel—A new, portable deburring and finishing barrel for laboratories, job shops, research and development departments and manufacturers with limited finishing needs is announced by Almco, Queen Products Division, King-Seeley Corp.

Called the Model DBM-10 "Super Mite", the new unit is especially intended for use in plants and departments processing small lots of parts. It is claimed to speedily debur and finish work parts at a fraction of the time and cost involved in hand operations.

The 12 in. diam. by 8 in. wide barrel has a $^1/_2$ cu ft capacity, and is equipped with a quick acting cam type door. It is driven at speeds variable from 19 to 38 rpm by a $^1/_{16}$ hp, 110 v motor.

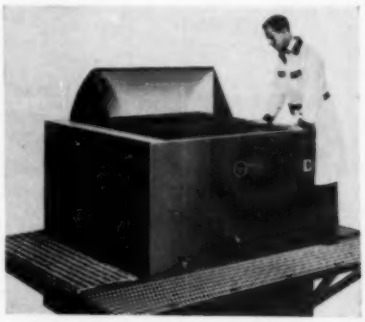
E—805. Nuclear Thickness Gage—RCL's ultra-sensitive nuclear thickness gage, Model 42000, measures: 1. Material thickness to two millionths of an inch without contacting material. 2. Thickness of protective coverings, coatings and impregnations to within 0.01 per cent of total material thickness; and 3. Changes in basis unit weight of .005 mg/sq cm.

Material to be measured flows past a small radioactive source. The gage measures the amount of radiation which passes through the material. Changes in material thickness cause changes in strength of radiation detected. This change is indicated in units of thickness or in weight per unit area.

E—806. Small Conveyor—Hanson-Van Winkle-Munning Co. has introduced the Fleximatic small conveyor to the plating industry. It was designed to incorporate many optional features. Among these is a dial which allows the operator, by setting it, to pick which treatment tanks a given carrier will enter or by-pass.

Vertical oscillation is another optional extra available with this conveyor. Sixty inches of oscillation a minute is the standard setting.

The Fleximatic is a return type processing or electroplating conveyor. The gross load for one carrier is forty lb, work and rack. The rack size is a maximum of 18 in. in the direction of travel, 14 in. thick, and 36 in. long with a 9 in. hook. The machine requires a head room of 9 ft 3 in. and floor space (width) 102 in. wide with 30 in. tanks.

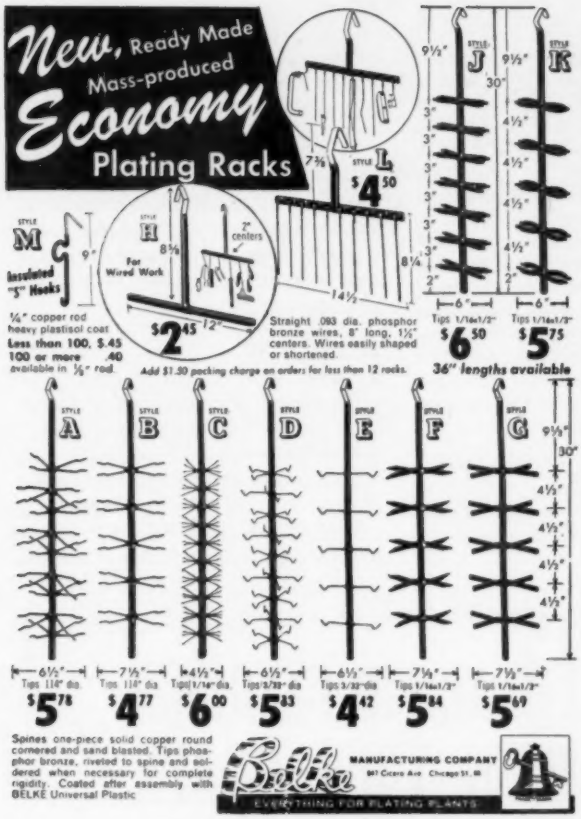


E—807. Multi-purpose Vibrator—The Vibratron, a newly developed machine for mass production cleaning, descaling, deburring, radiusing, fine finishing, and coloring of metal parts has been introduced by the Roto-Finish Co.

Complex cast, forged, stamped, and machined parts with shielded and internal surfaces are finished in the machine. Time cycles are very short with a rate of production reported by the company as up to 1000 per cent greater than parts processed utilizing conventional barrel finishing techniques. The process is also said to be very economical inasmuch as only a few ounces of compound are necessary to do an effective job.

Vibration is induced by a system of eccentric weights integrally mounted within the vibrating motor. The motor is mounted directly onto the bottom of the vibrating tank and is water-proof with low power requirements.

E—808. Steel Electrocleaner. Enbond Cleaner FE-84, a heavy duty, high conductivity, anodic cleaner for steel, has been introduced by Enthone, Inc. The new product is designed for high current



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1—1000 AMPERE, 40 VOLT, **CHANDEYSSON,** 25°C.

1—1000 AMPERE, 30 VOLT, **IDEAL,** Exciter-in-head.

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density, anodic cleaning of steel without danger of pitting or rusting of the work in the areas of highest current density. It is claimed to rapidly remove smut, oil and solid dirt and to produce a clean, water-break free surface.

Enbond Cleaner FE-84 is furnished as a free flowing, dustless powder. It is dissolved in water at concentrations of 8 to 12 oz/gal and operated at 180 to 200F. High current densities of up to 100 amp/sq ft can be attained at average operating voltages to promote more rapid cleaning and smut removal. The cleaning solution has high tolerance to dragged-in buffing compound which shortens the life of many electrocleaners.

E—809. Ultrasonic Cleaner—Blackstone Corp. is now manufacturing a new ultrasonic cleaner with interchangeable stainless steel tanks ranging in capacity from two quarts to six gal.

The new Model GW-4A ultrasonic system is available with interchangeable lift-out tanks in either round or rectangular shapes.

Good cleaning results are said to be obtained with any one of these interchangeable tanks. Extremely high sound density is produced in the smaller tanks.

The small tanks are used for the most difficult cleaning jobs and when the volume of parts to be cleaned is low.

E—810. Heavy Duty Ultrasonic Cleaners—A new line of heavy-duty ultrasonic cleaners designed for difficult cleaning problems is currently in production by Acoustica Associates, Inc.

This heavy duty line includes models GU 150, GU 420 and GU 720, and features average output power from 150 to 700 watts with tank capacities from 3 to 8 gal.

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CONTAINING each of the technical papers delivered before the AES's 45th Annual Convention held in Cincinnati, Ohio, May 19-22, 1958, together with their charts, diagrams, graphs, tables and other illustrations, and with the verbatim discussion that followed their delivery, TECHNICAL PROCEEDINGS (1958 Edition) broadly enriches technical and scientific knowledge in the field of electroplating, metal finishing and allied arts.

It also includes the stenotype report of the panel session on "Practical Plating Problems" that was a hit of that Convention.

A larger book than the 1957 edition, it also carries a front section that includes a complete chronological list of AES Conventions and Past Presidents; a day-to-day log of the 45th Annual Convention; a section on the AES Scientific Achievement Award and on the Paper Awards presented at that convention; a full listing of AES's 1958-1959 Boards and Standing and Special Committees and a complete Branch Directory up to date as at September 1, 1958.

The domestic price of the 1958 Edition of TECHNICAL PROCEEDINGS is $12 per copy including postage. To those ordering from outside of the United States' continental limits, the charge is $15 per copy including postage. All orders must be accompanied by payment in full. Address orders and make checks payable to:

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A limited quantity also exists of the 1956 book at $12.50 per copy domestic; $15 per copy foreign and of the 1957 book at $10 per copy domestic and $12.50 per copy foreign. All orders must be accompanied by payment in full.

It is designed for continuous duty and for unusually difficult cleaning operations such as cleaning heavily soiled gear trains, parking and water meters, castings, waveguide structures, etc.

E—811. Masking Coating—A new protective coating which reportedly will seal metal and stainless steel surfaces against the biting and cleaning effects of pickling and passivating, has been developed by Consolidated American Services, Inc.

CMS-N-202 is black in color and can be used to coat parts submerged in most plating solutions. It can be applied by brushing on, with spray gun, stencilled on, dipped, or any other conventional method of application. CMS-N-202 requires no mixing and no additives. It is ready for use as it comes from the container.

E—812. Silicon Power Rectifiers—International Rectifier Corp., announces a new series of low-cost 25 to 35 amp, 50 to 500 PIV-rated silicon power rectifiers designed specifically to provide exceptional performance (including operation to 130C base temperature) in commercial equipment applications.

This series embodies a new technical advancement in the sealing of silicon rectifier junctions termed "Quad-Sealed" —a four-layer seal said to assure high resistance to humidity, shock, vibration, temperature extremes and other adverse environmental conditions.

E—813. Waste Test Kits—Kocour Company is introducing three new test kits for checking plating waste effluents to meet the specific need for simple control by the plating and metal finishing industries. The methods are based on procedures furnished by the Lancy Laboratories of Zelienople, Pa.

These new test sets have been simplified for quick spot test checks to determine the presence of cyanides, copper and chromic acid.

The test kits are complete and ready to use. They include all of the necessary reagents, dropping pipets, spot plate, and easy to follow directions contained in a handy card board box for convenient use and storage. No knowledge of chemistry is required to make a test.

E—814. Electroplater's Microscope—Bausch & Lomb Optical Co. announces a new electroplater's microscope designed to provide rapid, accurate measurements of plating thickness with high quality results.

The fine adjustment knob is located only a short distance above the table top, allowing the arm to rest in a natural position and is said to make easy, the slightest change in focus. The instrument features full-size control knobs which are easy to grasp for all adjustments. The objective is centered in a single nosepiece, and the instrument is easily portable for on-the-spot examination and analysis.

Balcoted optics for maximum light transmission, and one micron divisions on the fine adjustment knob are said to assure the most accurate results in focusing on the specimen. Further accuracy is provided by the Filar Micrometer eyepiece, which includes a movable hair actuated by a micrometer screw with a drum graduated in 100 divisions.

E—815. Heavy-Duty Tumbler—Suitable for large-scale production in parts finishing, grinding and deburring operations, the Rampe Model 30 precision barrel finisher features Floating Power drive. This eliminates chain and sprocket mechanisms and permits simple, handwheel speed changing from 8 to 25 rpm. A built-in magnetic brake and protective safety guard in front of the barrel provide full control and safety.

Additional features of the Model 30 include: interchangeable barrels with a choice of one to three compartments, no-seam orange vinyl plastic lining in barrels, forward and reverse, jogging switches, and extra-rugged, heavy-duty welded steel construction.

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ARTICLE REFERENCES

By
WILLIAM TUCKER
Eastman Kodak
Rochester, N. Y.

Most of the articles listed here may be obtained by writing to the publications in which the articles were published. Addresses are given at the end of the references for the reader's convenience.

Photostat or microfilm copies of articles in available magazines may be obtained from: Library of Congress, Washington, D. C.; New York Public Library, New York; Engineering Societies' Library, New York, at prevailing rates. In other cases, consult Wilson's Union List of Serials at your nearest public library for other sources of these articles.

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a. *STUDIES OF THE STRUCTURE OF ANODIC OXIDE FILMS ON ALUMINUM 1.*
D. J. Stirland and R. W. Bicknell.
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a. *GUIDE LAMP'S NEW APPROACH TO PLATING AUTOMOTIVE DIE CASTINGS.*
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Concentration Displacement in (Silver) Plating Baths. A. V. Krusenstjern and H. Schlegel. (Metalloberfläche, 1958, 12, (4), 119–122). (P. 617—Silver).

Zinc Plating of Articles by the Use of Bipolar Electrodes. Yu. V. Kuz'min (Sbornik Ratsional. Predlozh. Ministerstvo Elektrotekh. Prom. U.S.S.R., 1956, (6), 25–26; C. Abs., 52, 18015–18016)—The main features of the method consist in placing the metal in the bath between the anode and the cathode in such a manner that it conducts the current much better than the electrolyte. Cathodic reactions will occur in the sections of the conductor nearest the anode; anodic reactions will similarly occur in the sections nearest the cathode. This results in a reduction in resistive potentials along the desired direction of the lines of force, i.e. the throwing power of the solution is improved. The method permits a reduction in Zn plating time from 7 hr to 10–15 min. A design is proposed for holders which ensures the plating of articles by the above method. In acid baths a bright finish is obtained without the formation of scratches. (P. 618—Zinc).
Pick Up 6 pt matter

May 1959, p. 697:

Influence of the Conditions of Electrodeposition and Electrolyte Composition on the Porosity of Electrodeposited Nickel Coatings. A. L. Rotinyan, N. P. Fedot'ev, E. E. Mishchenkova and Dë Du-kho. (Zhur. Priklad. Khim., 1957, 30, (5), 716-723)—(In Russian). Carefully cleaned and polished Cu or Fe plate cathodes were Ni-plated from specially purified electrolytes and high-purity Ni anodes. The porosity (P) of the coating were determined by counting under a microscope after making the pores visible by 10-min immersion in a soln. contg. NaCl 10, $K_3Fe(CN)_6$ 10 g/l followed by a few sec in a soln. contg. $K_4Fe(CN)_6$ 40 g/l; this was more sensitive than the standard filter-paper method. With a bath contg. $NiSO_4.7H_2O$ 166, H_2BO_3 30, $Na_2SO_4.10H_2O$ 50, $MgSO_4.7H_2O$ 20, NaCl 20 g/l, P decreased rapidly as the thickness (t) increased, but becoame almost const. at t = 20μ. P was a min. at a cd of 1.5 amp/dm^2, a $NiSO_4$ concentration of 0.7–0.9M, a H_2BO_3 concentration of 0.45M and a *p*H of 4–5. P also decreased sharply with rise in temp., becoming const. at 50C. Agitation had no effect. Addn. of Na_2SO_4, $MgSO_4$ and NaF increased P, but impurities (Cu, Zn, Pb) only began to affect P when they also began to cause cracking of the deposit. The recommended bath contains $NiSO_4.7H_2O$ 220, NaCl 10 (or $NiCl_2$ 10–15), H_2BO_3 30 g/l, *p*H 4.2–4.6, 1.5 amp/dm^2, 50C, t 20μ.

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National Association of Corrosion Engineers
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Corrosion Technology
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PERSONALS

George J. Hetz was recently appointed general manager of C & W Metal Finishing Inc. in Los Angeles, California. Mr. Hetz is co-chairman of the AES 47th annual convention to be held in Los Angeles, July 24–28, 1960.

George J. Hetz

A. R. McNeil

Arthur R. McNeil, vice president and New England sales manager of MacDermid Inc. has been elected a director of the company. He will continue his duties as New England sales manager in addition to serving the company in broader management and policy decisions. Mr. McNeil joined MacDermid in 1945 as a technical sales representative. In 1953 he was named New England sales manager and in 1957 was named vice president. He is past-president of the Bridgeport Branch of the American Electroplaters' Society.

•

Wellington Vandeveer will take over the post of president, of the Circo Equipment Co. He succeeds Melville Morris, who has resigned from the company.

Mr. Vandeveer was formerly sales planning manager for Merck & Co. He has also

S. Carlson

W. Vandeveer

been connected with the management consultant firm of Booz, Allen and Hamilton. A graduate of Williams College '39, Mr. Vandeveer lives on Douglas Road, Bernardsville, New Jersey.

Severn Carlson was named to direct sales activities for both Circo Equipment and the newly formed subsidiary, Circo Ultrasonic Corp. He has been a sales engineer with Circo for five years; prior to that he was a product engineer with Wallace and Tiernan for six years. He is a graduate of Lehigh University '48 and lives at 21 Woodland Avenue, Mountain Lakes, New Jersey.

Benson Carlin was appointed executive vice president of the subsidiary. He was formerly head of Alcar Instruments, Inc.

•

Earle R. Loomer Jr. has been appointed merchandise manager for the Gainesville (Georgia) mill of Deering, Milliken & Co., Inc. Mr. Loomer's entire business career has been in the textile field. One of the current major projects under Mr. Loomer's guidance is the buff cloth program inaugurated in 1958.

E. R. Loomer Jr.

L. R. Danek

L. R. Danek has been appointed by Industrial Filter & Pump Manufacturing Co. as a regional sales manager for the Eastern area and as advertising manager for the company's overall program.

Previous to his present appointment, Mr. Danek served the company as an application engineer. He was earlier associated with Swift & Co., Chicago, as a research engineer in the company's Research Laboratory.

He received the BS degree in chemical engineering from the Illinois Institute of Technology in 1954.

•

T. A. Leonhardt is now a consultant and service engineer on electrolitic generators and motors, with offices at 43 Tyler Ave., Webster Groves, Mo. He was formerly with Chandeysson Electric Co. His 36 years of experience were chiefly as assistant to Dr. Chandeysson in the design, manufacture and service of motor-generator sets.

Robert D. Bradford and **Edward McL. Tittmann** have been elected executive vice presidents of American Smelting and Refining Co., and **Charles F. Barber** and **Forrest G. Hamrick** have been elected vice presidents. Mr. Barber also was elected a director of Asarco.

Mr. Bradford, who has been a vice president since 1952 and a director since 1957, came to work for Asarco in 1926 as a junior metallurgist. Since that time he has had widely diversified experience in the company. Presently he is president of Lake Asbestos of Quebec, Ltd., Asarco's wholly owned asbestos producing subsidiary, and is in charge of the company's Federated Metals Division.

Edward McL. Tittmann joined Asarco in 1929 as a chemist in Salt Lake City, following his graduation from Massachusetts Institute of Technology. In 1955, he left the company to become president of Southern Peru Copper Corp., returning to American Smelting in December of 1958 as vice president in charge of smelting and refining operations.

Charles F. Barber came to Asarco in 1956 as general counsel, leaving his post as assistant to the Solicitor General of the United States.

A native of Chicago, Mr. Barber is a 1939 graduate of Northwestern University, and a member of Phi Beta Kappa. In 1942 he graduated from Harvard Law School, where he was an editor of the Harvard Law Review. He received a BPhil degree in International Economics from Oxford University in 1948 as a Rhodes Scholar. During World War II, Mr. Barber served as a Lieutenant Commander with the U. S. N. R. in the Pacific Theatre, where he was awarded the Legion of Merit with Combat Clasp and a Letter of Commendation from the Secretary of the Navy, with medal.

Forrest G. Hamrick began his business career with Guaranty Trust Co. of New York in 1933, and a year later joined the investment counsel firm of Scudder, Stevens & Clark in Boston as an analyst. He joined Asarco as a financial and economic analyst in 1946.

Born in New York City, Mr. Hamrick attended Lawrenceville School in New Jersey. He received a BA degree with honors in mathematics from Princeton University in 1931, where he was elected to Phi Beta Kappa. He specialized in finance at the Harvard Graduate School of Business Administration and was awarded an MBA in 1933.

Benjamin P. Fortin has been appointed to the Los Angeles technical service staff of Oakite Products, Inc., manufacturers of specialized chemical compounds for the metal industries.

An Oakite representative for nearly twenty years, Mr. Fortin was previously assigned to Tyler, Texas. In Los Angeles, he will concentrate his services on the metal industries.

B. P. Fortin

R. L. Rice

Robert L. Rice, P.E., has become associated with Lancy Laboratories as vice president in charge of its Philadelphia office. The research and development laboratory is located with the Pittsburgh office at Zelienople, Pa. under the direction of Dr. L. E. Lancy, president. Mr. Rice was director and vice president of Fischer & Porter Co., Hatboro, Penna.

•

Max Fraze, owner and operator of Mid-States Plating Service in Brighton, Mich., has been appointed by the Gilbert Tramer Co. to sell complete Tramer anodizing and plating plants in Michigan and Indiana.

Mr. Fraze spent nine years as purchasing agent for the Hardy Mfg. Corp. and has represented Smoothex, Inc. for seven years, selling and servicing bright plating processes. He attended DePauw University, where he majored in chemistry.

M. Fraze

O. A. Stocker

Oscar A. Stocker has been appointed as sales engineer for the New England States for Sel-Rex Corp., Nutley, New Jersey.

A graduate chemical engineer of the University of Michigan, Mr. Stocker has held technical and executive positions in the electroplating industry for over 33 years. He was chief chemist for Bohn Aluminum & Brass Co. for eight years, and was associated with Seymour Manufacturing Co. for over 16 years, most recently as divisional technical director.

Prior to his current assignment, Mr. Stocker was sales and service engineer with the United Chromium Division of Metal and Thermit Corp., for five years.

•

Dr. R. M. Kary has been named member of the research staff, Metal & Thermit Corp., Dr. Kary formerly was employed by American Smelting & Refining Company, South Plainfield, New Jersey.

A native Austrian, Dr. Kary received his PhD in organic chemistry from the University of Vienna. He is a member of the American Chemical Society, the Metropolitan Microchemical Society, and the Scientific Research Society of America.

•

Joseph E. Rhoads has been appointed assistant to the general manager of Enthone, Inc. of New Haven, Connecticut, a subsidiary of American Smelting and Refining Co. He will assist with the many administrative duties connected with Enthone's operations in this country and abroad.

Mr. Rhoads joined Enthone in 1953 as resident engineer for Ohio, Western Pennsylvania, Western New York and West Virginia and worked closely with the exclusive Enthone distributor in that area, R. O. Hull and Co. Previously, he was assistant to the executive vice president of the Cleveland Chain and Manufacturing Co. He is a graduate of Case Institute of Technology with a degree of BS in metallurgical engineering.

J. E. Rhoads

A. R. Tefft

A. Robert Tefft has been promoted by Enthone to resident engineer in Cleveland succeeding Mr. Rhoads.

Mr. Tefft has had extensive experience in the metal finishing field. After attending the University of Rhode Island, he became electrochemist for Blacher Bros., Providence. He joined Enthone in 1956 as a chemist in the technical service laboratory where he worked on a wide variety of customer's problems. For the past two years he has been resident engineer in Chicago assisting R. B. Goodsell, senior resident engineer in that area.

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Peter Arnold has been promoted to sales engineering staff of Hanson-Van Winkle-Munning Co.

Mr. Arnold became associated with H-VW-M as a consulting engineer in 1954.

Mr. Arnold is a graduate of Rutgers University. He holds a BS in aeronautical engineering. Before joining H-VW-M, he was associated with Eastern Aircraft Corp., a division of General Motors, and the Stratford Pen Corp. where he was in charge of research and development.

He is a member of the American Chemical Society, the American Society of Tool Engineers, the American Ordnance Association and the American Electroplaters' Society.

Peter Arnold

Charles E. Bagwell

Charles E. Bagwell has been elected to the board of directors of Hanson-Van Winkle-Munning Co.

Mr. Bagwell joined the company in 1956 as chief engineer. In this capacity he was in charge of all equipment design and engineering for the company's extensive line of automatic metal finishing machinery and processes. In 1958, he was appointed vice president in charge of engineering. The following year he was elected vice president, Equipment Division.

Prior to joining H-VW-M, Mr. Bagwell was associated with Westinghouse Electric Corp. for eight years. From 1954 to 1956 he was vice president in charge of engineering for the consulting firm Tammen and Denison, Inc.

●

John Kerber and **Herbert A. Wilson** have been promoted by Commercial Filters Corp., Melrose, Mass.

Mr. Kerber has been named manager of the company's New York Office. His headquarters will be in Ridgefield, New Jersey, where a complete stock of filtration equipment will be maintained. A graduate of the University of Arizona, he has been with the company's Chicago Office for the past two years.

Mr. Wilson has been appointed eastern district manager, with headquarters at the company's main office in Melrose. He will cover the entire Atlantic Coast. He graduated from Northeastern University and has been with the company for the past eight years.

Robert Hulland, formerly American Buff Co. representative in Eastern Michigan for three years, will represent the manufacturer in Upstate New York and Eastern Ohio.

Glen Beckwith has joined the American Buff Co. as sales representative for the state of California. He was formerly with Metallon Products and Kwikset Locks.

Mr. Beckwith will headquarter in Los Angeles. He is a registered professional engineer and an active member of the American Electroplaters' Society.

●

Edwin W. Vereeke, formerly executive vice president, has been elected president of Heil Process Equipment Corp., succeeding Carl E. Heil, founder and former president, who was elected chairman of the board of directors.

Mr. Vereeke graduated from Ohio Wesleyan University in 1943. After doing graduate work at Western Reserve University, and serving in the Navy, he joined Heil Process as an estimator in 1946. He became sales engineer in 1948; sales manager in 1950; vice president sales in 1952; executive vice president in 1954; and has now become president within 16 years after graduating from college.

Mr. Vereeke is a member of the Cleveland Athletic Club, the Cleveland Engineering Society, the Sales Executive Club, and also the National Association of Corrosion Engineers having been a charter member and past president of its Cleveland chapter.

E. W. Vereeke

Dr. L. Schiffman

Dr. Louis Schiffman has joined Amchem Products, Inc., Ambler, Pa. and has been assigned to the company's Metalworking Chemicals Division. He will do research and development work.

Dr. Schiffman came to Amchem from the Atlantic Refining Co. where he was a member of the research and development department. For two years prior to this he was with DuPont's organic chemicals department. He is a member of the American Chemical Society, the American Institute of Chemical Engineers, and the Phi Lambda Upsilon and Sigma Xi, honorary societies.

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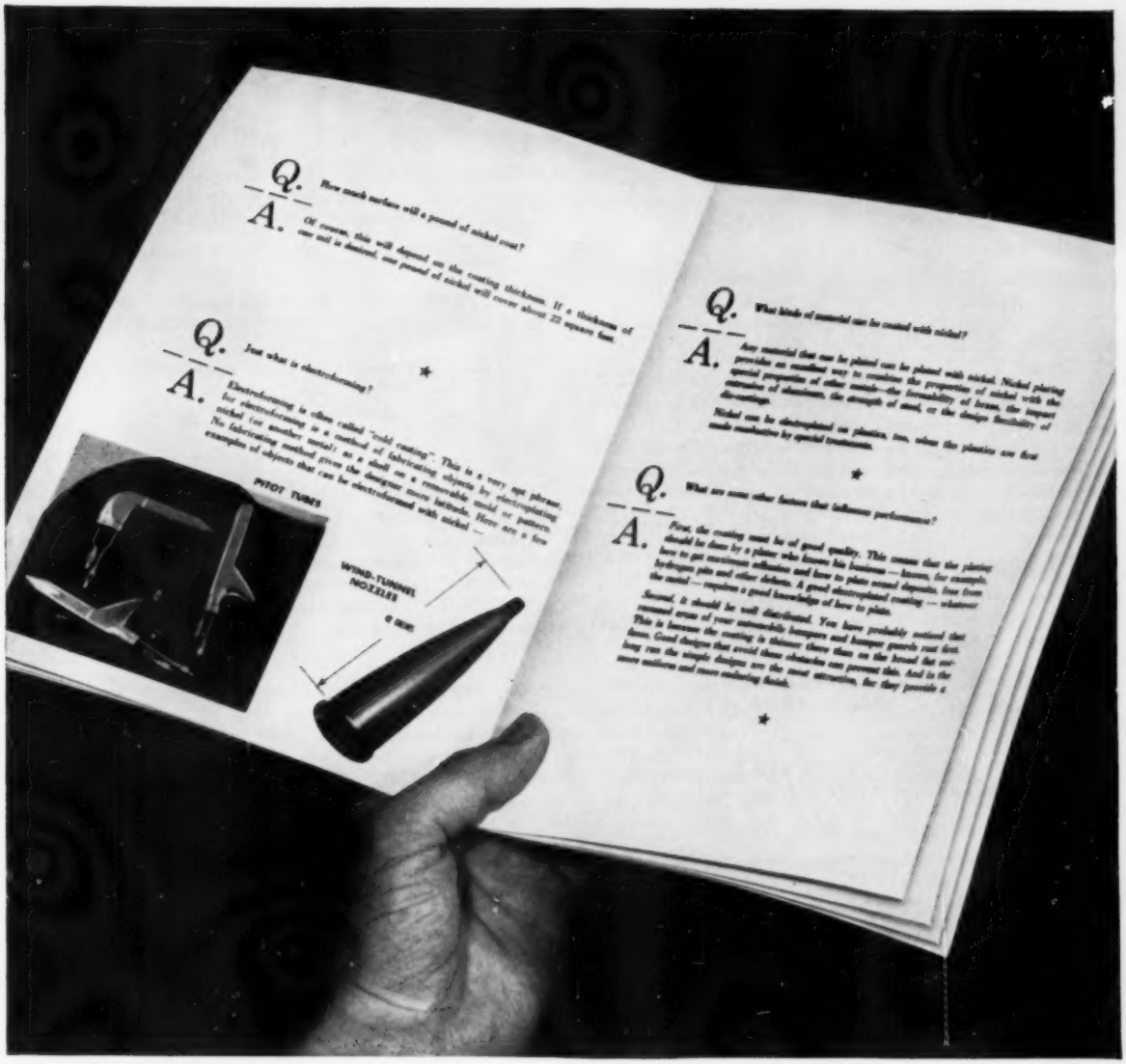
PATENT ABSTRACTS

Contact base metal under vacuum at 650-680F with gaseous



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What's more, it illustrates many of the parts that can be formed at less cost by electroforming or "cold casting"...how Nickel can be plated even on many non-metals...how more uniform coatings on complicated shapes can often be achieved by the new electroless processes.

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Inco Nickel

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PATENT ABSTRACTS

(*Continued from page 969*)

No. 2,867,546, 1/6/59—Gas Plating of Aluminum—W. MacNevin, assignor to Commonwealth Engineering Co., Dayton, Ohio.

The use of aluminum triisobutyl for plating aluminum on surfaces is described. See another gas plating patent, No. 2,867,552, describing plating of conductive coating on nonconductive filaments in 2 claims.

10 claims.

No. 2,867,568, 1/6/59—Production of Hydrides—G. Cunningham, assignor to Horizons, Inc., Cleveland, Ohio.

Electrolyze a fused salt bath containing alkali metal hydroxides and alkali metal halides to get an alkali metal hydride.

5 claims.

No. 2,867,569, 1/6/59—Electrolysis Process—R. Kronenthal, assignor to Colgate-Palmolive Co., New York, N. Y.

A procedure for the production of aliphatic alcohols and olefins consists of electrolyzing a solution (10 per cent water) containing the sodium salt of an alyphatic carboxylic acid and a lower alyphatic ketone.

4 claims.

No. 2,869,560, 1/20/59—Processing Machine—V. Finston, assignor to The Meaker Co., Chicago, Ill.

An electroplating, return-type, conveyor is described.

17 claims—15 figures.

No. 2,871,550, 2/3/59—Composite Chromium Electroplate—M. Weinberg and H. Brown, assignors to Udylite Corp., Detroit, Michigan.

A laminated corrosion-resistant coating for a metal base is described as being composed of 0.03 to 0.2 mil of chromium, 0.2 to 2 mil of nickel and finally of 0.005 to 0.1 ml of chromium.

18 claims.

No. 2,872,346, 2/3/59—Metal Plating Bath—A. Miller, Great Neck, N. Y.

For immersion plating copper on aluminum the use of a bath containing a copper complex of a water soluble amine. Example I describes a bath as:

Copper sulfate	10 grams
Ethylene diamine (70 per cent)	10 grams
Water	90 grams
*p*H	over 10.5

14 claims.

No. 2,872,350, 2/3/59—Deposition of Tungsten Carbides—H. Homer and J. Whitacre, assignors to The Commonwealth Engineering Co., Dayton, Ohio.

Contact base metal under vacuum at 650–680F with gaseous tungsten carbonyl.

2 claims.

No. 2,872,352, 2/3/59—Method of Producing Articles for Enameling—F. Porter, et al, assignors to Inland Steel Co., Chicago, Ill.

Treat enameling iron or steel exhibiting pickle lag by pickling to remove the pickle lag layer in a bath containing an adherence promoting metal above iron in the E.M.F. series (Cu, Pt, In, Pd, Rh and Au).

3 claims.

No. 2,872,353, 2/3/59—Chemical Nickel Plating—D. Metheny, assignor to General American Transportation Corp., Chicago, Ill.

A continuous process for depositing electroless nickel is described.

See also No. 2,872,354 assigned to the same company (7 claims).

17 claims.

No. 2,872,357, 2/3/59—Blocking Layer on Selenium Rectifier—S. Fry, assignor to Fansteel Metallurgical Corp., New York.

Describes a blocking layer made by applying a solution of a titanium compound capable of hydrolyzing to oxide, hydroxide or hydrated oxide of titanium, hydrolyzing and drying the film.

See also No. 2,872,358 describing the use of titanium halide for the same purpose (8 claims).

11 claims.

No. 2,872,359, 2/3/59—Copper Sensitizers—E. Saubestre, assignor to Sylvania Electric Products, Inc., Mass.

Sensitize an insulator substrate by immersing in an alkaline solution containing the hydroxide complexes of gold ($HAuO''_3$), Platinum ($Pt(OH)''_6$) and palladium ($Pd(OH)''_6$), and electrolessly depositing copper on the substrate.

3 claims.

No. 2,872,361, 2/3/59—Stripping Metal Coatings—H. Siefen and J. Campbell, assignors to U. S. A. (AEC).

To remove Al-Si alloy bonded to an uranium article with a Al-Ur-Si alloy interface. Dissolve the Al-Si alloy with hot alkali, subject the interface to concentrated nitric acid and then shot blast.

5 claims.

No. 2,872,362, 2/3/59—Battery Electrolyte—M. Mendelsohn and C. Horowitz, assignors to Ions Exchange and Chemical Corp., New York, N. Y.

An alkaline battery electrolyte is described as concentrated KOH containing p, p' isopropylidenediphenol in an amount exceeding 0.1 per cent by weight of the solution.

2 claims.

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dent, automatically became a member of

November meeting at Anderson, and the

BRANCH NEWS

Total AES Branches U. S., Canada, Australia, July 1, 1959 — 58.

BALTIMORE-WASHINGTON

Withers Presents Nickel Plating; New Officers Elected

The regular monthly meeting of the Baltimore-Washington Branch was held Tuesday evening, May 12, 1959 at the Regent House Hotel, Baltimore, Maryland.

The speaker for the evening was **James C. Withers,** Melpar Corporation, Falls Church, Virginia. Mr. Withers spoke on "Better Nickel Plating" including the use of periodic reverse current in plating from non-aqueous mediums. Mr. Withers also spoke of superimposing ac current on dc in the chloride and the Watts types baths and the effects of these on the properties of the deposit. Mr. Withers' talk was illustrated with numerous slides.

The main business of the evening was the election of officers for the coming year. The following were elected: president, **Edward E. Oberland;** vice president, **Harold W. Scott;** secretary, **Edward J. Roach;** treasurer, **Lancaster Lowry;** librarian, **Joseph Eisenberg.**

Three men were elected to membership.

Harold W. Scott
Secretary

BLUE RIDGE

Ericson Speaks on Organic Coatings

The Blue Ridge Branch held its regular monthly meeting April 3 at the Elks Club in Roanoke, Virginia. T. R. Boggess presided.

Two new members were elected.

Bob Ericson, assistant technical director of Pittsburgh Plate Glass Company gave a talk on Organic Coatings and Application Methods. Samples of coated articles were circulated and new coating materials were discussed.

It was announced that the next meeting would be held in Roanoke and the program would be a visit to the G.E. Plant. **P. D. Callahan** in charge.

Carl Witherspoon
Secretary-Treasurer

BLUE RIDGE

Tour GE Roanoke Plant

The Blue Ridge Branch held its regular monthly meeting, May 1, at the Elks Club at 6:30 p.m.

P. D. Callahan, librarian, gave a short introduction of the Roanoke GE plant describing the controls manufactured there. The group was led to the plant near Salem and conducted through all phases of the finishing plant. Among the highlights were the automatic plating installations, automatic organic coating systems, use of plastisols, barrel finishing, high speed spot plating and zinc coating of castings.

It was announced that at our next meeting at Winston-Salem, June 5. The program scheduled to be a tour of Bossick-Sack plant under the direction of **Bruce Wallace.**

Carl A. Witherspoon Jr.
Secretary-Treasurer

CHICAGO

Ledford Discusses Plating Room Purification

The June meeting of the Chicago Branch was held Friday, June 5, at the Western Society of Engineers, 84 East Randolph Street. President **Charles Geldzahler** called the meeting to order and one application for membership was turned over to the Board of Managers for approval. **Ed Smith** gave a preliminary report on the Golf-Outing for the Branch. The outing will be held on Friday, September 25, at the Itasca Country Club, and the cost will be ten dollars including an excellent dinner.

Librarian **Simon P. Gary** introduced the speaker of the evening, **Ray Ledford** whose subject was "Purification in the Plating Room." Mr. Ledford, a graduate in chemical engineering at the University of Western Michigan, was president of the Branch, member of numerous AES committees and author of many papers on plating. After working for several companies in the plating field, he is now head of his own company, The Chemray Corporation. Mr. Ledford discussed the means by which contaminants get into plating baths (1) by plating racks (2) rack coatings (3) tank linings (4) from sizings of anode bags (5) impurities present in the chemicals (6) air-borne materials such as dust, etc. There are seven common methods to rid contaminants in plating baths (1) drag-out or by dumping portions of the bath (2) oxidation with the use of potassium permanganate, hydrogen peroxide, sodium perborate (3) by reduction using sodium hydrosulfite and formaldehyde (4) precipitation as used in the purification of bright nickel baths with a high *p*H or the removal of carbonates in cyanide copper baths with the use of lime (5) by adsorption using activated carbon or clay to remove organic contaminants (6) electrolytic purification of plating baths using low current densities, 2–10 amp/sq ft (7) by the use of Ion exchange to remove trivalent chromium, nickel, iron, copper and zinc from chromium plating baths. The above metals when removed resulted (1) in better coverage (2) higher current-densities (3) better operation of the bath (4) and in lowering the resistivity of the bath. To remove the trivalent chrome effectively, the use of potassium permanganate to oxidize the trivalent chrome to the hexavalent stage followed by filtration (to remove manganese dioxide) and then passing through Ion-exchange resins was necessary. Ion-exchange resins are also used to remove aluminum from chrome and anodizing baths and aluminum bright dips. After a question and answer period, Mr. Ledford was given a rousing vote of thanks for his interesting and informative talk.

Christopher Marzano
Publicity Chairman

CINCINNATI

Branciaroli on Modified Hull Cell; Picnic Held

The May 27 meeting was called to order at the Hotel Alms by President **Stephenson** with 33 members and guests present.

Ray Barry reported that the arrangements for the picnic have been finalized and it will be held on Saturday, June 27, 1959, at Sharon Woods Lodge from 12 noon until 11:00 p.m. The festivities will include the annual ball game between the Platers and Suppliers, a horseshoe tournament, an egg throwing contest, afternoon snacks, steak dinner, and a Monte Carlo session.

Lee Howald reported that the date for the 6th Annual Tri-State Regional Meeting will be Saturday, April 23, 1960, at the Sheraton-Gibson.

The speaker for the evening was **Joseph Branciaroli** of Diamond Alkali Co., who discussed the "Modified Hull Cell". The talk was augmented with slides which pictured the Modified Cell and some of its applications. The biggest limitation to testing with the Hull Cell has been the terrific increase in temperature of the bath being tested. The Modified Cell used in the proper manner can hold the temperature of the bath to +2 F in a 5 minute test at 15 amp. Therefore, the

BRANCH SECRETARIES

Branch News is required of all Secretaries monthly by AES Bylaws. First of the month is Branch News deadline for next PLATING issue. Any items on hand on that date will be carried in that edition. Later arrivals will appear in the issue immediately following. In reporting talks given by speakers before the Branch, please give titles of the talks, the speakers' full identification and any other pertinent information of interest to other Branches and PLATING's broad readership.

Modified Cell is a good research and control instrument. A question and answer period followed.

The sponsor for the evening was the McGean Chemical Company, **Jay Becker** as host.

David L. Kaplan
Secretary

DAYTON

Miller Explains Spray Painting; Ladies Night Ends Season

The May meeting of the Dayton Branch was held as a dinner meeting at the Yum Yum Restaurant on May 20. During the business sessions the Delegates were instructed to oppose any dues increase exceeding $2. They were also instructed to oppose changing the due date for per capita tax to Sept. 1 as it was felt that this does not allow ample time for the members to make payment and would result in a heavy drain on the bank account. A new member was welcomed.

After a report from **Herman Austen**, chairman of the Nominating Committee the following were elected to office for the coming year: **Bennie Cohen**, president; **Byron Bowman**, first vice president; **Larry Hadlock**, second vice president; **Richard Wright**, librarian; **Richard Clinehens**, secretary; **Duane Prosser**, Treasurer. **Jack Baker**, retiring president, automatically became a member of the Board of Managers.

It was announced that the next meeting will be a Ladies Night and will be held at the Moraine Products Gun Club on June 5. It will feature sports, lunch, and Monte Carlo with prizes and refreshments.

Dr. Emery P. Miller, Ransburg Electrocoating Corp. of Indianapolis gave an excellent explanation, accompanied by colored movies, of Electrostatic Spray Painting.

L. A. Critchfield
Publicity Chairman

INDIANAPOLIS

Reynolds Heads Branch; Future Meetings Planned

At a special meeting on June 1 at Fox Steak House with **John Hood**, president, presiding, the following were elected for 1959–60: President, **Les Reynolds**; first vice president, **Phil Petro**; second vice president, **Paul Johnson**; secretary, **Edna Rohrabaugh**; treasurer, **John Holland**; librarian, **Mark Trook**; board of Managers: **John Hood, Roman Bender, Quentin Shockley**; Delegates: **Bert Hawker, Abe Max** and the secretary.

Future meetings were discussed and invitations have been issued for the October meeting at Columbus, Indiana, the November meeting at Anderson, and the February 1960 meeting to be a joint meeting with The Electrochemical Scoeity. This last invitation was issued by Abe Max and accepted by the Branch. Exact date will be set later.

Checking the membership of the Indianapolis Branch for members of 15 years or more is in progress, as reported by **Ed Bruck.**

A vote of thanks was given to outgoing officers in a motion by Les Reynolds and seconded by **Phil Petro.**

Edna Rohrabaugh
Secretary

LOUISVILLE

Round Table Discussion; Election of Officers

The regular meeting of the Lounsville Branch was held on May 21 at Hasenour's Restaurant.

The following officers were elected for the coming year: president, **Joe Muscarella**; first vice president, **Herb Rembold**; second vice president, **Jim Smith**; librarian, **Harlan Bowsher**; treasurer, **Art Oertel**; corresponding secretary, **Charles Whitt.**

Ken Reifsteck was elected as the Louisville Branch "Man of the Year." This designation is given to the member who has done the most for the branch in the various fields of activity.

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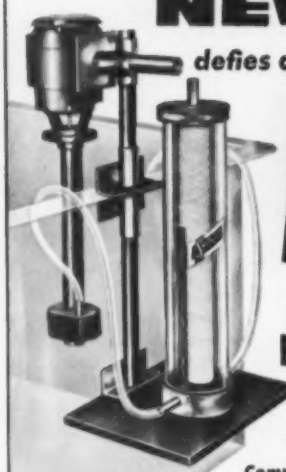

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The Annual Round Table was very successful, answering plating and technical questions with a marked degree of expertness. The panel consisted of: **Bill Young,** Bill Young & Co., Moderator; **Tom Brentlinger,** Reynolds Metals, Anodizing **Herb Kennedy,** DuPont, Cyanide Baths, **Elmer Rehme,** Metal & Thermit Co., Ni & Cr.

Stanley Beyer gave a short dissertation on the satin chrome installation of General Electric's Range Department. **Bob Goodsell** discussed briefly the history of the Enthone-Ardco combination and the meeting adjourned after refreshments served by Enthone.

Louis W. Dawson
Recording Secretary

MILWAUKEE

Pinner Silver Anniversary Meeting

The 500th regular meeting was held on June 3. Following a general get-together by the members, talking over old and new times, singing the "old songs" and having a wonderful social time, the call was given for a tempting buffet dinner. While the members were partaking of the delicious food, they were entertained by "Shirley" and her accordion and vocal solos.

The Pabst meeting was called to order by President **Frank Marshall.** He welcomed the out-of-town guests and extended an invitation for the next meeting.

A minute of silence was held for **Louis Bush,** who passed away in late May.

Glen Schwemer, meeting chairman, announced that this was the twenty-fifth **Walter Pinner** Anniversary Meeting and thanked his committees for the aid they had given him.

W. Kessler, H. Bornitzke and **Mr. Anglim** gave short talks on the Milwaukee Branch. Judge Wm. O'Neil was then called upon and he spoke of his association with Walter Pinner and also gave a detailed account of the accomplishments of Mr. Pinner in the field of science, which are not only national but international as well.

Mr. Pinner thanked the members for the honor bestowed upon him and voiced his appreciation for the wonderful reception the Milwaukee Branch had given him. He then spoke briefly on the coming Detroit Golden Jubilee Convention and outlined in detail the educational sessions to be presented.

Mr. Pinner was asked to show color slides of his trips to Arizona and the members were highly pleased with the program he offered. Upon completion of the slides, he was presented with a silver serving set in recognition of his anniversary.

An invitation was again made to the Milwaukee members to a Racine Nite in September. The Racine group is planning a "couples" affair this year at Meadowbrook.

The installation of officers was made by Mr. Pinner and he charged them with their new offices, urging a continuing fine record of the Milwaukee Branch.

The new president, **Cy Taterczynski,** thanked the members for their support in his election and spoke a few words on the aims of the Branch in the coming year.

Frederick F. Padgett

MOHAWK VALLEY

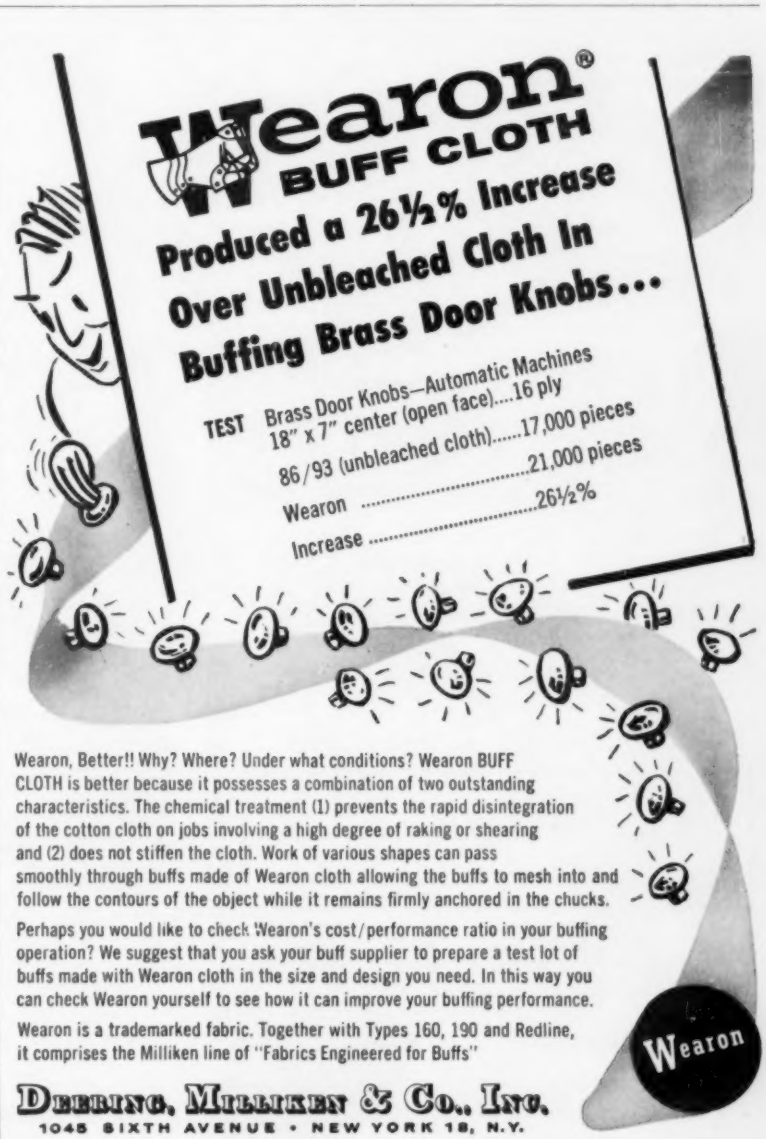
New Officers Elected; Walczyk Talks on Printed Circuits

The May 14 meeting of Mohawk Valley Branch at Thompson's Hotel, Yorkville, was opened by President **C. A. Bridgett** who announced that the Syracuse Branch clam bake will be June 13.

The officers elected for the year 1959–1960 are **Jack Bension,** president; **R. A. Stewart,** first vice president; **Merle Ihrie,** second vice president; **Ted Duvall,** librarian; **H. J. Crouse,** secretary-treasurer and **C. A. Bridgett, Frank Czech, J. J. Cox Jr., James Luker, Merwin Warren** and **Phil Jankiewicz,** board of managers

Jack Bension introduced the speaker of the evening, **Walter Walczyk,** a member of our Branch. His topic was "Printed Circuitry." The speaker cited the need and use of compact and miniature circuits with light weight and reliability at reasonable cost. He stated that some computing machines require thousands of units and printed circuits are a most satisfactory means to accomplish this.

Mr. Walczyk noted that most of the methods used are not new but the plating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H. J. Crouse
Secretary

MONTREAL
Smith Talks on Precious Metals

The regular monthly meeting of the Montreal Branch was held at the Sheraton-Mount Royal Hotel on June 1.

President **R. Takeuchi** presided with 22 members present.

Mr. Takeuchi called upon **D. C. Lloyd** to introduce **Frank K. Smith,** president of Technic Inc.

Mr. Smith gave a very interesting talk on Precious Metals in Electroplating.

Mr. Smith was thanked on behalf of the Branch by **B. Millward.**

Two applications for memberships were accepted unanimously.

R. W. Niggemann
Secretary

NEW YORK
Chessin Discusses Adhesion Testing

The May 22 meeting at the Hotel Statler was called to order by President **Joseph Rembecki.**

One application was forwarded to the Board of Managers for further study.

This being an open meeting all business was dispensed with and Librarian **Martin Pollack** introduced **Dr. H. Chessin** of the Van Der Horst Corp. of America. Dr. Chessin's paper on Engineering of Adhesion in Plating Deposits was very well presented. With the aid of slides, Dr. Chessin introduced a method for testing the adhesion of plated deposits called "The Push Out Test." Also using slides he covered porous chrome plating and showed various operations at his plant, which has the second deepest chrome tank in use. They specialize in porous chrome and iron plating for the railroads and other heavy equipment users.

The usual question period following the paper brought some interesting facts on adhesion of plated deposits and iron plating.

Fred Saras
Recording Secretary

PHILADELPHIA
Bellinger Speaks on Chromate Coatings

The regular meeting on May 25 at the Engineers' Club was attended by 41 at dinner and about 65 at the meeting following. One active member was admitted and four membership applications were received. Following the reading of the minutes and the treasurer's report, first vice president **Cogan** discussed the June 19 Ladies Night and gave details on tickets and food selection.

The following were elected to office for the 1959–60 term: President, **James E. Cogan Jr.**; first vice president, **Edward M. Hoffman Jr.**; second vice president, **Irvin K. Hauseman**; secretary, **I. Wm. Marcovitch**; treasurer, **Paul Mentzer Sr.**; librarian, **Joseph W. Berenato Jr.**; Board of Managers, **Robert L. Farren**; delegates, **Dr. Samuel Heiman,** I. Wm. Marcovitch, James E. Cogan Jr.; Alternate Delegates, Edward M. Hoffmann Jr., Irvin K. Hauseman, **William H. Trusdell.** The new officers were installed by Past Supreme President Heiman.

Dr. Heiman introduced six graduates of his Temple University plating course. Retiring president Robert L. Farren presented incoming President Cogan with the Branch gavel. Mr. Cogan presented Mr. Farren with a past president's pin.

Irvin Hauseman, as his last official act as librarian, introduced the speaker, **K. P. Bellinger,** Conversion Chemical Corp., whose topic was "Modern Trends in Chromate Conversion Coatings." Mr. Bellinger gave the background of the

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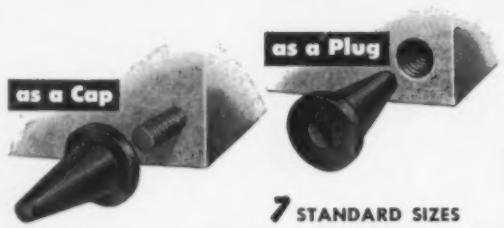

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I. Wm. Marcovitch
Secretary

SPRINGFIELD
Golf Outing and Installation; Heissfeld Receives Pot

The Springfield Branch held the third Annual Golf Outing, Installation of Officers and Banquet on Saturday, May 23, at the Whippernon Club, Russell, Mass., and more than 50 members and their guests were present.

The afternoon was given over to the golf tournament, horseshoes, and general good fellowship. At 7 p.m., everyone sat down to a delicious roast beef dinner.

Immediately following the meal, **John E. Costigan,** in his capacity of installation officer, explained the duties to and then swore in the following: President, **Elery C. Gibson;** first vice president, **Alexander R. Salmond;** second vice president, **Martin J. Murray;** secretary, **Henry L. Heissfeld;** treasurer, **George H. Mongeau;** and librarian, **Louis E. Dupuis.** Mr. Costigan presented **Edward F. Koetsch Jr.** with a past president's pin, and then installed him, with the following as the Board of Managers: **Henry S. Cummings, Joseph F. Mitchell, Wayne B. Sanders** and **Donald W. Gemme.**

Following the installation ceremony, **Charles F. Griffin, Jr.,** last year's recipient of the Order of the Pot, was called on to present the gold pot to the individual who he felt most deserved it. Mr. Griffin presented the Pot to the Branch secretary, Henry L. Heissfeld, who will have the honor of keeping it for the 1959–1960 Season, and who will then choose the following year's recipient.

Following this presentation, **Wayne B. Sanders,** as Chairman of the Activities Committee announced that after a compilation of the golf scores, the winner of the Branch with the lowest net score proved to be the second time winner—**Elery C. Gibson.** Mr. Gibson was presented the Colin M. Hastie Memorial Trophy, and as a second time in succession winner, he had the option of retaining the trophy in his permanent possession, or returning it to active competition for next year's tournament. Mr. Gibson generously returned the gold cup to open competition.

Prizes were distributed to the next lowest golf score holders, both members and guests. The winner of the horseshoe pitching team was Elery C. Gibson and Henry S. Cummings.

A number of valuable door prizes were won by lucky individuals, through the generosity of suppliers and other friends of the Springfield Branch.

The members of the Activities Committee assisting Wayne Sanders to make this affair such a successful venture were: Martin J. Murray, Alexander R. Salmond, **Ernest P. Donaruma,** Charles F. Griffin Jr. and Elery C. Gibson.

Henry L. Heissfeld
Secretary

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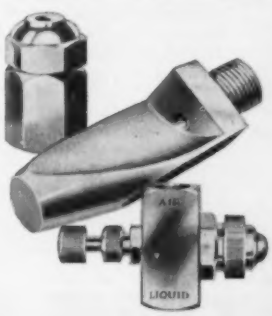

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Montreal	Polytechnique Institute	Dr. Andre Honé	$50	3 yrs.
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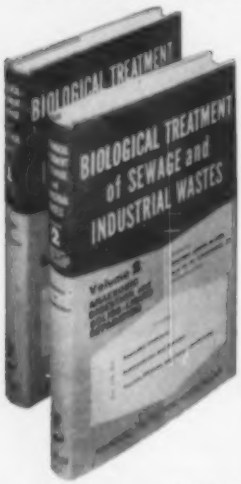

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September 11-12, 1959—**Executive Board,** Statler-Hilton Hotel, Detroit, Mich.

September 18, 1959—**Editorial Board,** National Headquarters, Newark, N. J.

September 25, 1959—**Research Committee,** National Headquarters, Newark, N. J.

September 25, 1959—**Metropolitan Regional Educational Meeting,** Joint meeting New York and Newark Branches, New York Host Branch, Penn-Top Room, 8 p.m., Hotel Statler, New York, N. Y.

October 3, 1959—**Montreal Branch,** 5th Annual Dinner-Dance, The Queen Elizabeth Hotel, Montreal, Canada.

November 7, 1959—**First Midwest Regional Conference,** All Day, Rockford College, Rockford, Ill. Sponsored by AES Midwest Regional Council.

January 15-16, 1960—**Second Annual Dixie Regional Technical Session,** Saxony Hotel, Miami Beach, Florida. Sponsored by Miami Branch with Blue Ridge and Southeastern participating.

January 30, 1960—**Chicago Branch,** Annual Meeting and Banquet, Conrad Hilton Hotel, Chicago, Ill.

April 23, 1960—**Sixth Tri-State Regional Meeting,** Cincinnati Host Branch, Sheraton-Gibson Hotel, Cincinnati, Ohio.

April 29-30, 1960—**Sixth Empire State Regional,** Southern Tier Host Branch, Mark Twain Hotel, Elmira, N. Y.

July 24-28, 1960—**47th AES Annual Convention,** Hotel Statler, Los Angeles, Calif.

June 18-23, 1961—**48th AES Annual Convention,** Hotel Statler, Boston, Mass.

June 25-28, 1962—**49th AES Annual Convention,** Schroeder Hotel, Milwaukee, Wis. Sponsorship Midwest Regional Council.

June 24-27, 1963—**50th AES Annual Convention,** Ambassador Hotel, Atlantic City, N. J. Sponsorship Newark Branch.

June 21-25, 1964—**51st AES Annual Convention,** St. Louis, Missouri

INTERSOCIETY

September 21-25, 1959—**Instrument Society of America,** 14th Annual Instrument-Automation Conference and Exhibit, International Amphitheater, Chicago.

FUTURE MEETINGS

October 7-9, 1959—American Vacuum Society, Sixth National Symposium on Vacuum Technology, Sheraton Hotel, Philadelphia, Pa.

October 11-16, 1959—American Society for Testing Materials, Pacific Area National Meeting (with Exhibit), Sheraton-Palace Hotel, San Francisco, Calif.

October 18-22, 1959—The Electrochemical Society, Fall Meeting, Deshler-Hilton Hotel, Columbus, Ohio.

October 21-24, 1959—Federation of Paint and Varnish Production Clubs 37th Annual Meeting and 24th Paint Industries Show, Convention Hall, Atlantic City, N. J.

November 2-6, 1959—41st National Metal Exposition & Congress, International Amphitheatre, Chicago, Ill.

November 5-7, 1959—American Chemical Society, Southeastern Regional Meeting. Symposium on Corrosion of Iron and Tin, Hotel John Marshall, Richmond, Virginia.

Nov. 30-Dec. 4, 1959—27th Exposition of Chemical Industries, New York Coliseum, New York City.

January 12-15, 1960—Society of Plastics Engineers—16th Annual Technical Conference, Conrad Hilton Hotel, Chicago, Ill.

February 1-5, 1960—Instrument Society of America, Instrument-Automation Conference and Exhibit, Houston Coliseum, Houston, Texas.

March 9-11, 1960—Instrument Society of America, Temperature Measurement Symposium, Deshler-Hilton Hotel, Columbus, Ohio.

May 1-5, 1960—The Electrochemical Society, Spring Meeting, LaSalle Hotel, Chicago, Ill.

May 9-13, 1960—American Society for Metals, 2nd Southwestern Metal Exposition and Congress, State Fair Park, Automobile Building, Dallas, Texas

July 24-26, 1960—National Association of Metal Finishers, 5th Anniversary and Membership Meeting, Hotel Statler, Los Angeles, California.

July 25-26, 1960—National Association of Metal Finishers, 5th Anniversary Management Seminar, Hotel Statler, Los Angeles, California.

September 26-30, 1960—Instrument Society of America, Instrument-Automation Conference and Exhibit and 15th Annual Meeting, New York Coliseum, New York, N. Y.

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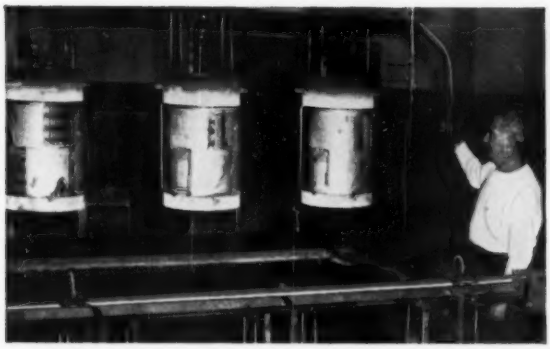

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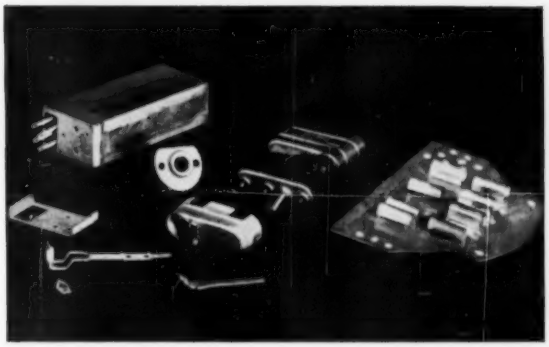

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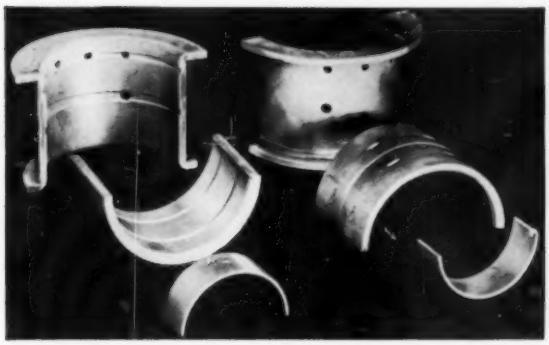

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